

Use of Active Learning and Group Competition To Facilitate Training and Technology Transfer for Adult Learners

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Adult training is different from the more traditional training used in many of today's public schools. Adults have more experiences on which to base their decisions and generally are more skeptical of education. There is a need for relevancy in the materials presented, and many negative impressions must be overcome. To address these and other issues, a number of techniques are now being applied to facilitate training and technology transfer for adult learners. A technology transfer program originally aimed at adults working for the Tennessee Department of Transportation (TDOT) was designed to educate workers about using metric units in the workplace. Because of the subject, the time constraints, and the generally negative reaction that participants in test courses demonstrated, the program was designed using several of the techniques now becoming popular in adult education. Besides the use of short lectures, these techniques included active learning and group competition, using games and exercises with token rewards for success. Nearly 4,000 individuals have attended the program in Tennessee and Kentucky. Participants have come not only from TDOT but from city and county governments, contractors and engineering firms, and suppliers. Participants' job responsibilities have included everything from clerical to company president and owner. Follow-up surveys have revealed a strong positive response to the program and a belief that technology transfer via training is being accomplished successfully using this combination of training techniques.

A major part of the process of transferring technology involves the concept of training—more specifically, training adults. Unfortunately, many training techniques do not adequately take into account the characteristics unique to adult learners that can make standard methods of training less than effective. One methodology (used with more than 4,000 adult learners in a metric training project at the University of Tennessee Transportation Center) that has been identified as very useful in adult training and technology transfer is the process of active participant learning combined with group competition. This paper examines the theoretical basis for active learning and group competition and then uses the metric training project to give practical examples of specific techniques that can be used to facilitate the technology transfer process via training.

The metric training course received excellent feedback from more than 4,000 adult learners from the Tennessee Department of Transportation (TDOT), private contractors, consulting firms, and local road authorities who attended the program. Hearing about our success, the Kentucky Local Technical Assistance Program (LTAP) center had us teach metric courses in their state. The majority of adult learners in more than 150 sessions commented how interesting the subject was and that they had fun participating and learning. The concepts used in designing the metric training course would be

quite applicable to adult learners in a large class setting, for those who would be reluctant to learn, where there would be a mix of experience with the subject matter, or where the participants would need a broad overview of a technical subject.

BACKGROUND THEORY

The effectiveness and long-term benefits from different types of educational processes have long been debated. The reason for much of this debate is the combination of such issues as cost and time effectiveness, human personality traits, and the various goals desired from different training programs. Early education from the time of Socrates involved great amounts of group discussion and was based upon the premise that students should actively participate in deciding what should be taught and how. Later education programs changed to a "lecture-and-test" philosophy as specific goals were created based upon the needs of industry and society (1). However, today there is a great deal of debate on this issue as educators, especially those dealing with adults, recognize that differences in program goals, education levels, and personalities of the learners and teachers—and even the time and funds allotted to a program—affect how technology transfer can best be accomplished.

During the past decade, educators have also begun to discover that adults learn differently than children. They have more life experiences to base their opinions on and have more issues affecting their willingness to learn specific pieces of information. They are continuously looking for relevance to their daily lives, both at work and at home. Additionally, workers re-entering education or attending workshops after a long absence commonly have a low opinion of their educational abilities and of education in general. Therefore, the way in which material is presented and taught has a tremendous impact on how well learners accept the information and benefit from the training. It is therefore crucial to stress that the experiences of those attending will help them with the materials and that they can approach the information based upon this knowledge (2). Thus, no single technique will work in all cases and for all people. Therefore, a combination of techniques may present the best chance of providing a satisfactory transfer of information in adult education.

Actively involving the adult learner in the training program is one of several techniques that has documented success in the area. Robert M. Smith, professor of adult education at Southern Illinois University, describes the ideal learner as one who is active and involved in the learning process by asking questions, teaching others, or participating in hands-on activities. His research indicates that these learners more often develop comprehension of the ideas and concepts of the material being presented and don't just memorize the

facts being presented. He concludes that active learners are more often able to apply the skills taught to new situations (3).

Other research supports this concept of making the student actively participate in at least part of the learning process. A 1984 federal policy report on higher education, *The Mortimer Report*, stated that lack of student involvement in the training process, along with absence of academic rigor, were the two leading deficiencies in undergraduate education in the United States (4). *The Wall Street Journal* has reported on this trend by stating that in active learning (also called "collaborative learning" or "cooperative learning" by various researchers), "students are asked to actively dig for knowledge while teachers coach from the sidelines" (5). Others have taken this concept even further by encouraging a "just-in-time" type of educational environment in which individual or class learning can change subjects or processes to research immediate questions or subjects based upon the learners' interests and needs. This type of education generally requires various types of information systems and very flexible instructors and teaching structures (6).

Nadine Rosenthal, director of the Center for Reading Improvement at San Francisco State University, encourages another type of active learning. She states that some material may need to be directly taught or lectured but that learners can participate through the creation of a verbalization process between the instructor and the learner. Here, the learners repeat the material in their own words back to the instructor or to other learners. This technique serves not only to make sure that the participants have correctly understood the information but to transfer the information from short-term to long-term memory (7).

The concept of having learners verbalize information to each other directly leads to another area of successful adult education: group learning. Even when group learning is not intended to be part of the learning process, informal social organizations within a classroom affect the learning process. This socialization can easily be seen in any activity when those who know each other sit together or choose each other during group activities. Therefore, understanding this influence and using it to assist the transfer of knowledge is encouraged by many educators. A number of research articles have shown that isolated students tend not to learn as much or as well as students who are embedded in a network of informal social relations (8). Harvard Medical School is just one of many organizations that has successfully relied upon the group learning process in their training—in this case in the New Pathway program, an educational process that has received a great deal of praise for its successes.

METRIC TRAINING PROJECT

In the fall of 1995, the University of Tennessee Transportation Center was asked to develop a training program to introduce the metric system to more than 3,000 employees of TDOT. During the development phase of the program, a number of key conditions led us to consider active learning and group competition as the methodology to use in the metric training project:

- The metric system was not popular; many of the participants disagreed with the necessity of learning metric concepts and in some cases were actually hostile to such a course.
- This would be a required course, so it was likely that many of the participants would feel coerced in having to attend.
- Large class sizes of 40 participants would be the norm, thus reducing the opportunities for direct, one-to-one instruction.

- A wide range of technical abilities would be found in each class, with participants ranging from senior supervisory engineers to equipment operators and clerical staff.

- There was a need to overcome the distrust associated with the metric system and to develop the realization it was easy, beneficial, and necessary for the organization and the employees.

- Techniques to encourage the participants in becoming confident in using the metric system as needed in their daily job would have to be included.

COURSE DEVELOPMENT AND STRATEGIES

To meet the requirements identified above, we developed an active learning and group competition course with a number of features:

- A class discussion on the relevancy, applicability, and usefulness of the course.
- Creation of teams made up of four participants, using self-selection at tables surrounded by chairs.
- Group exercises to encourage team members to learn from each other, to facilitate learning and to reinforce the concepts presented.
- Encouragement of group competition by offering a token reward to members of the winning team.
- The showing of group scores after the end of each module and utilizing low points, so every group would feel they had a chance to win.
- Hands-on exercises in which participants gained a practical feel for metric terms.
- Utilization of problems and examples directly from participants' work environments.
- Exercises that increased in complexity as participants gained understanding from completing each module.
- Material divided into small, easily learned units.

Course Relevancy

At the beginning of every course there is a period of evaluation by typical adult learners to determine if the course will meet their expectations. Adult learners want the course to be relevant, useful, and applicable to them. In the metric training project, this evaluation was made difficult by the fact that many students did not believe there was a need for their office or organization to use metric measurements and therefore to have metric training. It is important to bring these underlying issues out and be prepared to emphasize why a course is important, relevant, and applicable.

Use of Groups and Competition

Another issue was that the course had to be fun. Adult learners are used to being entertained and would be more willing to participate and learn if the material could be shown to be interesting and fun. One of the easiest ways to get adults to learn actively is to use games and practical exercises that directly relate to the subject matter at hand. In the metric course, groups would compete in the various exercises and games associated with each module, and each member of the team with the highest total number of points at the end of the course would be awarded a prize. Creating a sense of competition also encouraged participants within each group to work together.

In the course design, it was necessary to have a seating arrangement to suggest group work. Theater-style seating, with chairs arranged in rows facing the instructor, would have been counter-productive. It was important to set up the room with large tables and chairs that forced participants to sit together. This arrangement automatically created a sense of group or team, which also made it easier for participants to work together in the exercises. Groups would naturally be formed around tables as learners arrived. We tested the option of assigning participants into groups but found that this strategy immediately reduced the comfort level of the participants, which adversely affected group learning. Participants who knew each other generally sat together. Those who did not know anyone would be added to existing groups, which also helped in expanding group interaction. The ideal number of participants for a group was identified as four.

Many times a gulf exists between the instructor and the students that prevents the open sharing of ideas. However, adult learners are more willing to share ideas within a group because there is less risk of embarrassment. Another advantage of the group environment is the concept of overcoming a reluctance to participate through peer pressure. Because there is a competition, some members of the group invariably become interested in winning. They are usually able to encourage a reluctant group member to join and participate.

Groups also benefit by pooling knowledge, skills, and abilities. Developing a course that is not overly challenging for some participants and too easy for others is difficult. Using the concept of group interaction, it is possible for adult learners of different skill levels to work together and teach each other.

Adult learners are competitive to a surprising degree. For example, in many cases there were supervisors and staff workers in the same class, and there was definite glee when nonsupervisors won a particular exercise. Many times the token reward (in this case a hat) was not the reason people were questioning every answer with the instructor; the opportunity to be part of the winning group was most important.

In most standard theater-style lectures, students rarely challenge the instructor; they just sit and listen to what the instructor is saying. If this paradigm is changed, and active learning and group competition is encouraged, a change occurs in the learning. Now that points are being awarded only to those groups that have the correct answer, many of the answers provided by the instructor are challenged. Note that every answer has already been discussed and justified within the group, so participants are anxious to prove their answer correct.

This process of going over the answers is beneficial to everyone—especially if the instructor allows some answers to be changed. Participants start to invest in their learning process because they want to make sure their answers are correct. The entire class learns, and the process is very useful in helping the instructor identify misconceptions or areas that need further explanation. For example, one of the exercises asked if speed limits always increase when converting from nonmetric to metric units. Many participants answered this question wrong because they relied on the two examples in the hand-out material. With active learning and group competition, this question was hotly debated, which might not have been the case in a standard class format.

Another benefit of group learning is a reduction in apprehension about a new subject when participants see it done by their peers. Metric concepts initially can seem complicated, but when participants start to use metric units and see others in their group working through problems, they begin to see how simple it is. Many of the feedback

surveys had comments that related the surprise that participants had when they found out how easy the metric system was.

Exercise Development and Response

Research has shown that learning by doing (active learning) is far more effective than learning by reading or learning by listening. Therefore, it is necessary to create exercises that adult learners can participate in that are challenging, yet give them experience in the subject matter. A group exercise at the end of each module provides a further opportunity to reinforce what has been taught. Additionally, correcting the exercise as a group provides immediate feedback to the instructor about the level of comprehension by the class.

The exercises used in the metric workshops were designed to be practical—using real world examples—and fun, so that participants could play and get an intuitive feel for metric units. One exercise that initially surprised everyone involved having participants measure their own waist using a tape measure. People would be joking with each other while they did this activity, and there was a sense of camaraderie. Many of those attending were surprised at the numbers, and of course they flipped the tape over to see the imperial measurement to make sure they were correct. Taking something abstract like the metric system and relating it to something very understandable, such as your own waist measurement, and having the adult learners determine this for themselves, helps to drive home the relationship between metric and imperial units.

The exercises were also arranged in order of difficulty so that the adult learners got a sense of mastery as each concept was learned. The first exercise (accompanied by a video that showed many such examples) asked participants to identify everyday uses of the metric system. Modules 3 and 4 had additional exercises that involved real-world problems taken from participants' own work. Participants were then able to discuss specific job applications that reinforced the relevancy of the course. The final exercise was a fairly rigorous cumulative test that required a good understanding of the metric system. The exam was purposely designed to be too long for most students to do by themselves, which encouraged participants to divide up the work and solve it as a team. This reduced exam anxiety and again encouraged group learning.

Token Reward

It was important that there be a token reward for winners of the group competition. The participants seemed to need good-natured competition, though at times the latter exercises did get really intense. It sometimes seemed that people needed an excuse to compete; people would still compete if they knew there were no prizes, but an award made the competitive behavior acceptable. We chose hats as token gifts because they are generally prized in the industry and they provided marketing for our program. They were generally well accepted, and many of those receiving them wore them out the door at the end of the course.

It was useful to show the relative positions of all groups at the end of each exercise. This ranking of course increased the sense of competition. We also chose not to mark participants too hard on the exercises; we looked for excuses to give them points. It was important that the first few exercises did not require overwhelming skill so that the participants would feel that they all had a chance to win.

It was also important to mix the types and difficulty of the exercises, so participants without a lot of previous knowledge would still succeed in some exercises. In the metric course, two exercises required a bit of luck—which meant that highly skilled learners did not have an advantage.

PARTICIPANT AND INSTRUCTOR FEEDBACK

Advantages

The use of active learning and group competition as successful tools in adult learning is supported by our experience teaching the concepts of metric measurements to more than 4,000 adult learners from a variety of backgrounds. The vast majority of the feedback surveys identified hands-on exercises as very useful and often described how much fun participants had learning. The class also was noisy, and participants were actively involved, especially at the end. Many participants did not take their coffee break when they were given the option of extra time on the exercises.

As instructors, we noticed the difference in classes that used active learning and group competition. In standard training courses, it is sometimes difficult to get participants to interact and ask questions. The participants in this course were insistent in their need to get the right answer. Having the participants actively learning made the teaching process much easier because the participants took responsibility for their own learning. The final exam, which was cumulative, was also an excellent tool to evaluate the effectiveness of the course. Many groups got marks above 90 percent, which also indicates the effectiveness of the active learning and group competition paradigm.

Disadvantages

As successful as these techniques are, however, educators are beginning to understand that different individuals truly need different ways to learn. Rau and Heyl have spent years researching how various individuals react to group and active learning. Their findings suggest that although most learners benefit from these techniques, there is still a sizable number (20 to 30 percent) of learners who feel that they do not benefit from these techniques (8). To try to reduce this number, some educators have tried combining as many of the different techniques as possible into a technology transfer plan. Documented cases of such practices demonstrate improved learning by those participating but still note a small minority of learners not satisfied with the programs or not showing any advantages from them (9). Previous research has shown that there are preferred learning styles for different individuals. Our experience in teaching metric concepts support the findings from Kolb (10) that found that learners who are more technical and hands-on prefer to be taught using games, exercises, and small group discussion.

There were very few disadvantages of the combination of education techniques used in this metric workshop. The games and exercises were able to draw just about every individual into the program, and the addition of short lectures and videos provided the substance many attendees required. However, there were still cases where a few learners did not really participate. Some came with such negative attitudes that no amount of effort could draw them in. Others simply did not have even the barest minimum of background to relate to the material. If more than 30 percent in a single class did

not have basic skills, then active learning and group competition would not work. If there were only one or two members in each group who were not at the minimum skill level, other members of the group would be able to help them participate.

CONCLUSION

There are a number of other issues that must also be considered with technology transfer via training. Although the traditional model of program development (philosophy, needs assessment, priorities, goals and measurable objectives, identifying resources, implementation, and evaluation) does well in many cases, it does not perform well when the answers and solutions are not uniform for all participants. With children or groups whose knowledge and experiences are uniform, the processes can be simplified, but most adult training programs are different. Adult learners have different levels of experience, education, and desire to learn the information needed. Therefore, getting those who need the training involved in the training process is very important to make technology transfer a success (11).

This particular method of active learning and group competition is not a panacea for all types of adult learning situations. There might be cases where participants do not have the skill level to participate and other cases where learners choose not to participate. If there is a wide range in skill and the exercises can not be modified to meet the needs of the less skilled participants, these training techniques will not work. Thus, highly complex subjects requiring extensive background knowledge to comprehend could not be taught using this kind of active learning and group competition without some screening of participants.

However, active learning and group competition are tools that should be considered when developing training courses for adult learners. Many times when courses are developed, there is little effort to develop games and exercises that encourage group competition and active learning by the participants. There is a large body of research that has identified the benefits of active learning for training adults. Our experience with adult learners in our metric training project at the University of Tennessee Transportation Center has shown the many benefits of active learning and group competition methodologies. The concepts that were used in designing the metric training course would be quite applicable to adult learners in a large class setting, for those who would be reluctant to learn, where there would be a mix of experience with the subject matter, and where the participants would need a broad overview of a technical subject. This methodology requires more preparatory work to tailor the exercises to the skill level of the participants. Additionally, it often requires more active involvement by the instructor during the course, to deal with group issues. However, we have found that it is also more effective. This methodology is not applicable in every training course, but in many LTAP centers where technology has to be transferred to adult learners via training, the process of active learning and group competition would be valuable, efficient, and effective.

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