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SAE J2017 AUG89

**Developing
Technician Training**

SAE Recommended Practice
Issued August 1989

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DEVELOPING TECHNICIAN TRAINING

1. PURPOSE:

This SAE Recommended Practice outlines a systems approach to improve the servicing of automotive vehicles by improving the ability of service technicians to troubleshoot, diagnose, repair, and service as required. Specifically, it guides any organization planning and designing training materials and systems for the technician. This document addresses the industry problem of a decreasing supply of trained technicians at a time of increasing vehicle complexity. See Fig. 1.

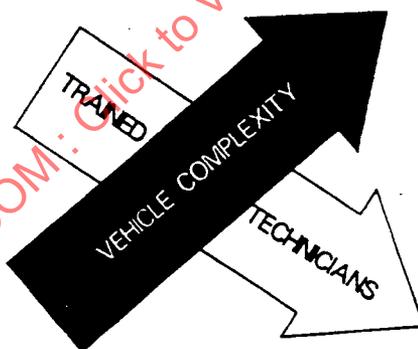


FIGURE 1 - Trends: As Vehicle Complexity Increases, Our Supply of Trained Technicians Decreases (from SAE Paper #870567)

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Comments on this Recommended Practice are invited from interested parties and can be submitted in writing to SAE Headquarters.

2. INTRODUCTION:

The basic principle of this systems approach is considering the output (the results of the training) as the governing factor rather than the input (the content or the course length). Training is considered in the broadest terms of improving human performance. It includes more than training programs such as manuals, clinics, and audiovisual materials. Training can include Performance Job Guides to assist the technician in on-job performance without requiring training or extensive memorization. It can include group training and self-paced individualized instruction.

3. DEFINE THE NEED:

Training expenditures are justifiable on the basis of improving job performance, insuring that the technician will do the job correctly. To learn about something which has no effect on job performance can be considered education, not training. Organizations planning training can properly delegate education as the responsibility of the individual. One procedure is the establishment of entry-level criteria, such as courses completed, books read, and pretests completed.

a. Determine the Human-Performance Deficiency: They're not doing what they should be doing. Read the human-performance trouble codes.

- (1) Determine the desired performance.
- (2) Determine the present performance.
- (3) Define the gap, the shortcoming, the need for improvement.

b. Determine the consequences of the performance gap; what will it cost if we don't change anything?

- (1) Comebacks - unhappy customers
- (2) Time lost
- (3) Parts wasted
- (4) Equipment damaged
- (5) Duplicated effort
- (6) Excess supervision needed
- (7) High turnover - disgruntled employees

c. Identify the shortcoming(s). Consider one or more factors involved in job performance (See Fig. 2):

- (1) Ability: Can he/she do the job? Has the knowledge and skills?
- (2) Attitude: Will he/she do the job? Has the incentive?
- (3) Conditions: May he/she do the job? Has the opportunity?

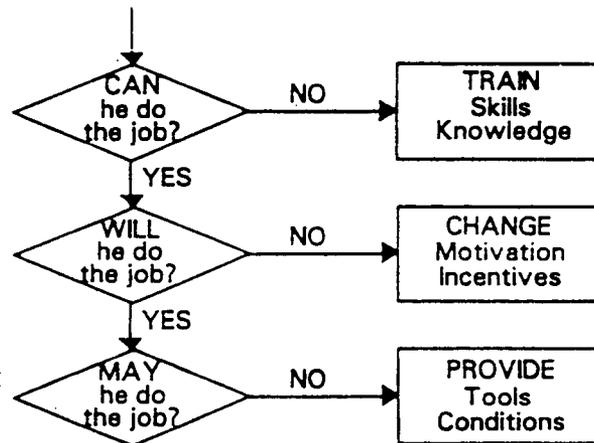


FIGURE 2 - Identify the Shortcomings
(from SAE #870567)

3. (Continued):

d. Devise a solution related to the kinds of shortcomings:

(1) If the technicians lack ability (knowledge and skills), determine if training is the necessary solution, but consider alternative solutions:

- If the job was done properly, but now regularly it is incorrectly done, provide feedback for recall of once-learned knowledge and skills.
- If, on the basis of feedback from training to service engineering, the vehicle can be changed over time so the proper human performance is easy or natural, the job will frequently be done correctly (if a connector is designed to attach only one way, no training is required regarding the way to connect it). (See Fig. 3).

**IF WE MAKE A THING
SO IT CAN BE DONE WRONG,
PEOPLE WILL DO IT WRONG**

FIGURE 3 - Murphy's Law, As He Meant It
Relates Training to Service Engineering

- If a Performance Job Guide, or a simple set of instructions can be attached to the vehicle, such as a vacuum-hose diagram and tune-up instructions on an underhood decal, little or no training is needed to memorize such information.

3. (Continued):

- (2) If the technicians have the ability, but lack the correct attitude (have enough skill, but not enough will), determine why they do not want to do the job. Lack of attitude is more a matter of incentives and disincentives than it is of training. Training is seldom effective in changing motivation. Rather, if the technician is failing to do the job properly, but does have the required knowledge and skills, examine the incentives:
- Is the technician punished when the job is done correctly? Does he lose pay for spending an hour on diagnostic work? If so, change motivation - reward him for proper human performance.
 - Is the technician rewarded when the job is incorrectly done? Is the technician paid for simply removing and replacing parts without knowing what will fix the vehicle? If so, change motivation - arrange positive reinforcement for proper human performance.
- (3) If technicians have ability and attitude, determine if conditions are preventing them from doing the job correctly.
- Has the technician been provided with the correct tools and test equipment? Don't expect the technician to run an emissions check if the 4-gas analyzer is down. Is the service bay well lighted? Does the technician have the time and the conditions to do the job correctly?

4. CREATE THE TRAINING:

When the systems approach shows that training is the best solution to the gap in human performance, continue a systematic program to design, develop and validate the training, using cybernetic feedback techniques, see Fig. 4.

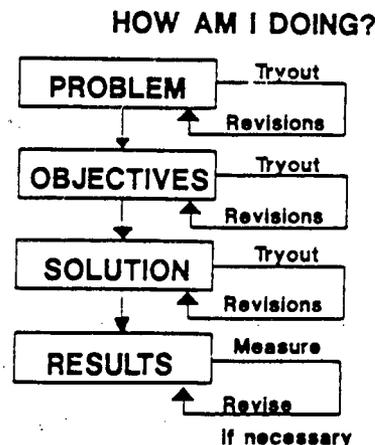


FIGURE 4 - Steps of Evaluation
(from SAE #870567)

4. (Continued):

a. Design the Program:

- (1) Identify the training requirements. What must change?
- (2) Formulate the performance objectives. What is a technician's job?
- (3) Construct the performance tests. How will we know when the technician completes the job?
- (4) Define entry level. What knowledge/skills does the technician need to begin?

b. Develop the Program:

- (1) Select the course content. Define the specific knowledge and skills.
- (2) Select the instructional strategy (self-instructional, group, instructor, media).
- (3) Produce the instructional materials. Produce these in draft form when possible to permit changes as a result of the next step.

c. Validate the Program:

- (1) Conduct the instruction.
- (2) Evaluate the instruction.
- (3) Administer and analyze the tests.
- (4) Revise as necessary and complete the program.

d. Follow up Graduates:

- (1) Determine the changes in the service.
 - Customer satisfaction
 - Technician performance
- (2) Advise management of the results of the training.
- (3) Maintain the program.
- (4) Use feedback to modify objectives, performance tests, training.

NOTE: Consider the total systems cost - delivery of training can represent 75% of the program costs (see Fig. 5). Training strategies should consider ways to minimize technician training time:

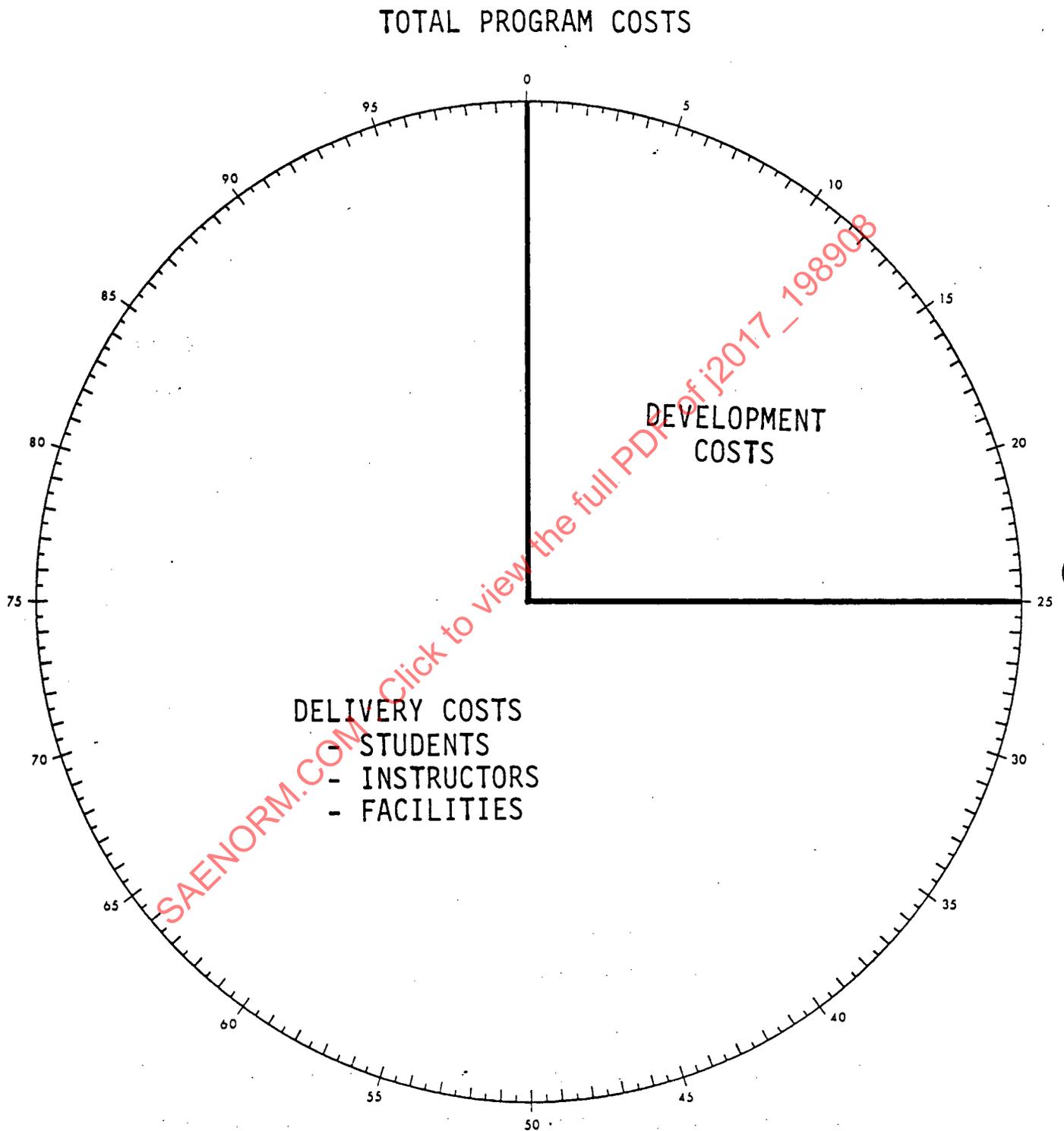


FIGURE 5 - Student Cost as a Major Part of the Total Program Cost

4. (Continued):

- Design for self-paced instruction to reduce instructor time costs.
- Recognize variations in learning rates, typically 4:1, i.e., the fastest trainee can learn four times as fast as the slowest.
- Concentrate on the need-to-know; offer more as enrichment.
- Design to improve human performance, to do the job more effectively.

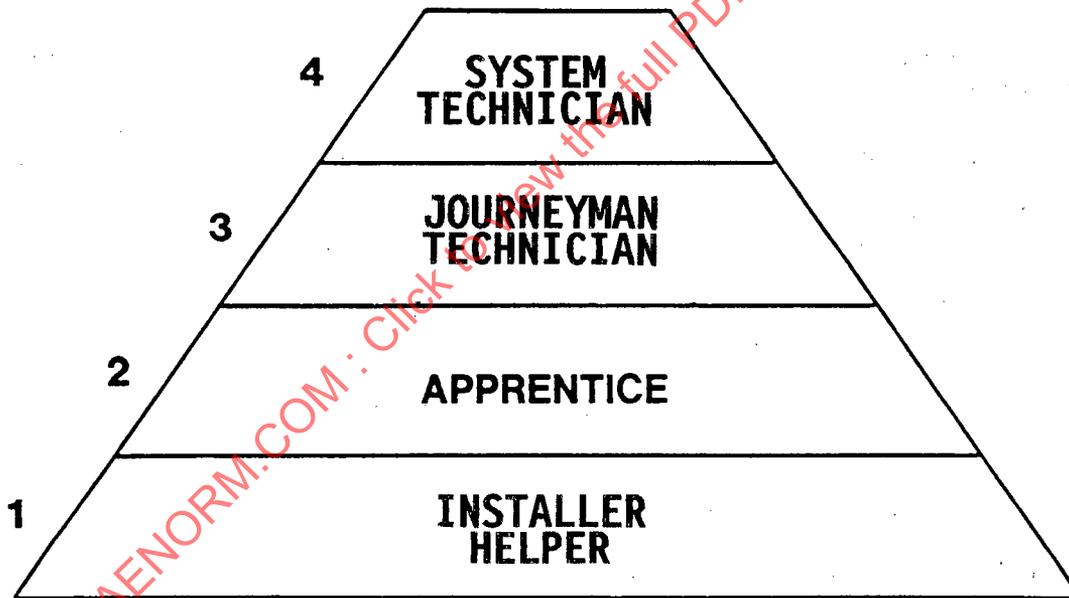
5. ESTABLISH LEVELS OF PERFORMANCE: See Fig. 6.

FIGURE 6 - Job-levels of Performance
(from SAE #870567)

Cost-effective training is designed to focus on the abilities and experience of each appropriate level. Offer opportunities for advancement but do not expect every technician to be fully qualified in the troubleshooting and repair of every complex system. Rather, plan and administer training to recognize a pyramid of levels of competence according to specified criteria.

- Level 1: Installer-helper. The installer-helper will start in a vo-tech school, or as a do-it-yourselfer, or with self-study. Installer-helper will be competent to:

5. (Continued):

- (1) Discuss basic operation using technical terms and identifying parts in eight passenger car ASE categories or truck or body repair, as applicable:
 - (a) General engine
 - (b) Automatic transmission/transaxle
 - (c) Manual drivetrain and axles
 - (d) Suspension and steering
 - (e) Brakes
 - (f) Electrical systems
 - (g) Heating and air-conditioning
 - (h) Engine performance

NOTE: Even though Level 1 technicians may later specialize, each should meet these basic criteria in all categories.

- (2) Describe how to remove and replace tires, batteries, accessories.
- (3) Demonstrate shop safety and use of simple tools requiring some level of manual dexterity.

b. Level 2: Apprentice will be competent to:

- (1) Describe in detail the operation of the eight ASE categories, or demonstrate broader knowledge and skills in one or more specialized fields.
- (2) Locate and interpret procedures in service manuals.
- (3) Perform routine inspections.
- (4) Perform routine maintenance.
- (5) Correct minor faults as described in manuals.
- (6) Remove and replace external parts.

5. (Continued):

c. Level 3: Journeyman/technician will be competent to:

- (1) Discuss theory in depth, relating to diagnostic procedures, system checks and tests.
- (2) Interpret test data and computer trouble codes.
- (3) Discuss problems beyond those covered in service manuals.
- (4) Demonstrate factory-approved diagnostic procedures.
- (5) Demonstrate R and R of any system component.
- (6) Restore the vehicle to specifications.

The journeyman/technician is ASE certified, either as a Master Technician, passing all ASE passenger-car tests, or a specialist in one ASE field such as engine performance.

d. Level 4: Systems technician will be competent to:

- (1) Demonstrate the ability to apply information from many sources, such as diagnostic equipment, service bulletins, and technical publications.
- (2) Troubleshoot difficult, beyond normal situations.
- (3) Show others how to service vehicles with near perfect efficiency.

Level 4 may be a new classification appropriate to today's high-tech vehicles. The systems technician should know many systems to understand the interactions. The systems technician may be a specialist in certain fields. The systems technician is a superior diagnostician who prescribes work to be done by technicians at Levels 2 or 3.

6. CONCLUSION:

We need to recognize the difference between training and learning, and even more, the difference between training and human performance in the service bay, the difference between the means and the end.