Can Training Increase Maintenance Costs?

Effective training results in learning to improve knowledge and performance. Ideally, job-related training should result in learning - becoming qualified to perform the job as expected – mastery of job skills and knowledge. Training methods have changed dramatically over the decades, embracing online and computer-based training models. Faster computers, broadband connections, and software capabilities have launched new models for more efficient training. Unfortunately, some job-related learning such as equipment operation and maintenance does not lend itself to computer-based training (CBT). The hands-on elements of job-performance requirements are lacking with CBT, and students with tactile learning styles struggle with the visual and auditory methods common to CBT.

A recently published report on the effectiveness of CBT in the U.S. Navy concluded that maintenance costs have increased “tens, if not hundreds, of millions of dollars” as a result of the Navy’s use of CBT. System-specific maintenance costs increased, excess maintenance hours accrued because of productivity losses, and additional education was required to achieve initial ratings since CBT was introduced. (More on this analysis later in this article). We should learn from the Navy’s experience.

Shifting from Schoolhouse Settings to CBT
Until 2003, the U.S. Navy used traditional schoolhouse instruction. Noncommissioned officers from the operational fleet were assigned to shore duty to serve as instructors. Their career experience provided students with important lessons from the fleet, anecdotal insights, and case studies. Hands-on experiences in laboratory settings using the exact equipment found aboard ships with instructor-introduced flaws and defects for troubleshooting and repair to provide real-world learning. Lecture and demonstration could also be adjusted to suit the needs of the individual students as needed.

This traditional approach to instruction was labor intensive. It demanded experienced officers’ time away from the fleet, required a duplicated capital investment for equipment, and appeared to require more training time than the emerging computer-based methods. This concerned Congress and the Navy brass.

Between 2003 and 2004, the U.S. Navy shifted Class A technical schools from traditional schoolhouse settings to computer-based training to reduce costs and training time before on-ship duty. Subject-matter expert instructors were replaced with learning facilitators. Students moved through learning modules at their own pace on personal computers.

Computer-based training under review
The Naval Inspector General (IG) initiated a review and assessment of the Navy’s computer-based training in May 2008 in response to concerns from the fleet about the knowledge level of sailors, along with anecdotal reports regarding CBT. In March 2009, CBT was the subject of the U.S. Naval Inspector General Report to the Secretary of Navy.

The study defined CBT as an “individual or group-based instruction using a computer as the primary training medium.” The review found that the courseware content and quality varied widely, delivery systems were outdated, and the instructional design of CBT curricula did not capitalize on adult learning theory principles. They also found that CBT was most effective in a blended learning environment versus a stand-alone training medium.

Job-related training: More surprisingly, the study said there was “no mechanism in place to ensure the course content was linked to sailor work.” There was little subject-matter expert or instructor input in
course content development. This resulted in a major disconnect between the training content and the on-job performance requirements. While the fleet expected an operator who can perform basic maintenance, the training curriculum trained in system operations only.

Another revealing finding: Despite the generally accepted assumption that “while a generation of Americans may be proficient in using computers for gaming and (social) networking, most have no experience learning academic or technical material via personal computers.” CBT proved largely ineffective with this generation.

Technological demands: CBT requires access to personal computers or an electronic classroom connected to network servers and a comprehensive learning management system (LMS) to electronically monitor progress, grades, and transcripts. Multimedia learning content and multiple users require up-to-date computers and sufficient network bandwidth capacity. The Navy IG study found that outdated computers, insufficient network bandwidth, and limited Internet availability contributed to frustrated students. Computers were freezing, pages were slow to load or were timing out, and there was unplanned course downtime. And some of the LMS came with more limitations: time consuming student use, extensive administrative requirements, and errors in testing.

Sea stories: One element often missing in CBT is the voice of experience. Instructors with real-world, hands-on experience who can answer specific questions are invaluable to the learning process, especially for adults. Students are motivated, learning is reinforced, retention is increased, and the ability to transfer learning to situations outside the classroom is enhanced. “Sea stories” help put the subject matter in context of the world of work and make learning enjoyable for both students and instructors.

Outcome based training: The U.S. Government Accountability Office (GAO) also conducted a review that included training effectiveness. The findings, published in the 2010 Report to Congressional Committees on Military Readiness (GAO-10-592), stated that “since 2003, the Navy has made significant changes to its training programs.” In its move to CBT, they “lack outcome-based performance measures to fully evaluate the impact of its training programs.” The GAO also reported a lack of “complete data to track personnel qualification times.” In its conclusion, the report stated that “while achieving (training) efficiencies is very important, particularly given the growing costs to compensate personnel, the Navy must still ensure that it can perform its mission safely and maintain adequate readiness.”

U.S. Navy sonar system maintenance case study
The Navy’s IG and GAO reports prompted further empirical study. A detailed analysis of the Navy’s CBT approach to system maintenance was performed, and the findings were published in September 2014.

This study focused on one type of Navy sonar system with significant maintenance labor and costs data analysis of pre- and post-CBT implementation. The report stated, “We determined that CBT’s use has adversely influenced the parts costs, actions and labor hours associated with operating and maintaining the AN/SQQ-89(v) (sonar system).”

Cost reductions cost more: Although CBT reduced training costs and times, actual on-job performance and proficiency were harmed. Specifically, system parts costs increased by $4,971 per year, maintenance actions increased by 21 to 32 to 36 maintenance actions per year, and maintenance labor increased by 730 hours. The study also revealed that sailors reporting to the fleet are not as well
prepared as the classroom-trained sailors of the past. “We find, for the first time in the literature, that CBT adversely impacts maintenance costs, actions and hours.”

The report went to state that “predicted excess maintenance costs for the AN/SQQ-89(v) (sonar system) since 2003 are approximately $16 million higher due to the Navy’s introduction of CBT. This cost estimate does not include the lost productivity due to excess maintenance hours and additional education required for each sailor to obtain their initial rating.”

Learning from the Navy’s experience
Maintenance and reliability professionals are experiencing the impact of skills shortages in today’s workplace and are concerned for the future. Many community colleges and tech schools do not offer the training needed for our equipment and facilities. High schools have dramatically reduced (or eliminated) career education and hands-on technical training programs relating to the skills and knowledge required for industrial and facility installation, maintenance, and repair. The temptation to jump on CBT as the fast-track to training our future maintenance staff is huge—and by itself, it is hugely ineffective.

Just because the younger generation is proficient at using computers, tablets, and smartphones does not mean they will be proficient at maintaining digital generation equipment. Nor does it mean they can learn technical skills from CBT modules. Hands-on abilities, mechanical aptitudes, and problem solving real-world equipment situations are a must.

CBT is a viable training methodology when the content is directly applicable to the workplace (job task analysis), facilitated by skilled practitioners (mentors), and coupled with hands-on the actual equipment (lab setting or formal in-plant on-job training). Learning to become proficient at industrial maintenance requires much more than learning from a computer program. Hands-on learning has to be the primary teaching and learning model for industrial maintenance technicians because of the hands-on nature of our work and the learning style of most people who pursue maintenance careers.

Let’s prepare our maintenance technicians of the future with efficient, effective job-related training using a combination of instructional media, classroom training, hands-on experiences, and on-the job mentoring by skilled and knowledgeable practitioners.

References:

Report to Congressional Committees on Military Readiness (GAO-10-592), U.S. Government Accountability Office, June 2010


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