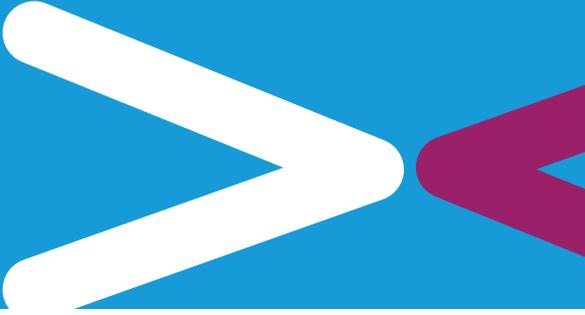


Protecting your Training Investment  
with Training Reinforcement

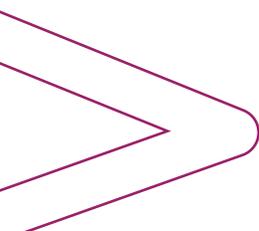


A Logical Operations Whitepaper

**If** you're involved in training (or even if you've ever had training), you have heard of the learning curve. But you may not know that the concept is nearly as old as experimental psychology itself. The learning curve was discovered by psychologist Hermann Ebbinghaus, who described it in *Memory: A Contribution to Experimental Psychology*, which was published in 1885. He did not use the term "learning curve," but he did plot learning success over time on a diagram to show the curve's exponential shape.

Ebbinghaus based his research on himself, recording experiments testing his success in learning three-letter nonsense words. He made up these words to generate learning content that would have no relation to knowledge he might already have. He would read out a list of these words repeatedly and then after a number of readings, would try to recall the entire list. He discovered that the more repetitions he read, the more success he had in recalling the list. His recall improved the most in the early repetitions and then the pace of improvement slowed until he finally mastered the list. This pattern of rapid advancement in the early stages and slow advancement in the later ones was the first demonstration of the learning curve.

Today, Ebbinghaus probably would have difficulty getting his work published. Modern researchers wouldn't consider experiments on himself to have external validity. But he was the first person to ever apply scientific principles to the study of memory, and his work has been confirmed repeatedly with new subjects since its original publication (Plucker, J. A., Ed. [2013]. *Human intelligence: Historical influences, current controversies, teaching resources*. Retrieved November 25, 2013, from <http://www.intelltheory.com/ebbinghaus.shtml>.)

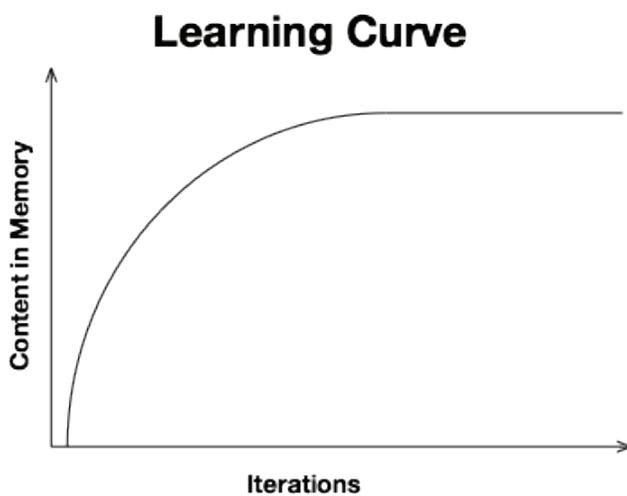


## The Forgetting Curve

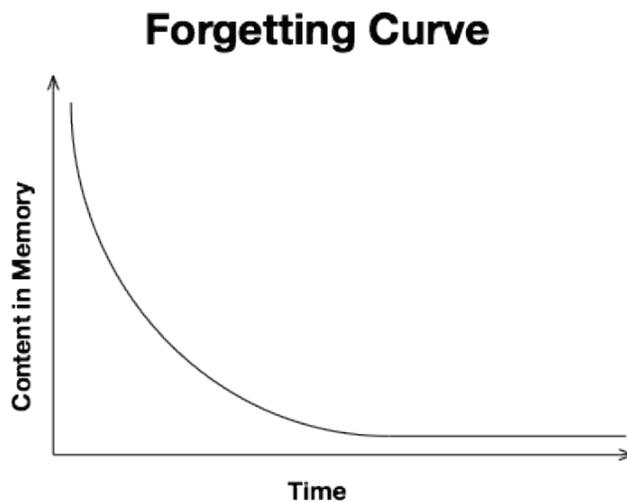
But as soon as Ebbinghaus discovered the learning curve, which describes how quickly you learn information, he discovered the forgetting curve, which describes how quickly you forget newly learned information. After successfully recalling a list of words, Ebbinghaus tested his recall of the list at different times, ranging from

20 minutes to 31 days. He found an exponential curve of forgetting. He lost the information most rapidly in the first 20 minutes. The rate of loss slowed after that but was still high in the first hour. After 24 hours, he had lost about two-thirds of the information.

Against Ebbinghaus's findings, we have the well-known axiom (cited regularly in training blogs) that learners lose 90% of what they learn within three weeks. Here at Logical Operations, we have run down dozens of leads trying to find the source of this axiom, with no success. It is even cited in Wikipedia with the notation (at this writing) "citation needed."



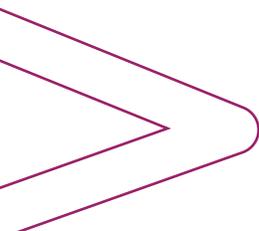
Because every learning process is unique, every learning curve is unique. This idealized representation shows its essential features: rapid progression in the beginning, followed by a long slowing in the rate of gain.



As with learning, every forgetting process is unique and has a unique curve. This idealized representation is a mirror image of the learning curve: rapid loss in the beginning, followed by a long slowing in the rate of loss.

Despite the caveats, however, the concepts of the learning curve and the forgetting curve have held up very well since 1885. Anyone who has ever tried to remember a grocery list has felt the exponential shapes of the learning curve and the forgetting curve. The precise timing varies from learning task to learning task, from learner to learner, and from instructional strategy to instructional strategy. But nobody really disputes that both curves are steep in the beginning and flatten out later. Today, you can find learning curves cited in a wide variety of disciplines, from economics to manufacturing, from robotics to biology. A simple Internet search on “learning curve” produces more than 39 million hits, including films, businesses, and social events bearing the name. The idea is thoroughly embedded in the modern consciousness.

The good news is that lost learning is an opportunity to improve the effectiveness of training, which is another way of saying to improve the return on the training investment.



## The True Costs of Training

To get an idea of what kind of benefit we can expect from reducing this lost learning, we'll do a brief refresher on the total cost of a training investment.

There are four general categories of training costs:

- Course content costs
- Training delivery costs
- Indirect costs
- Participant costs

**Course content costs** are the salaries and benefits of the content developers and the costs of the resources they need, such as software and equipment. If you purchase or license your courseware from a firm like Logical Operations, you perceive these costs as a single fee.

**Training delivery costs** include training materials, the costs of technology used in the training, possible rental of the training facility (such as a conference center), the travel costs of the trainees to and from the training event, the costs of training equipment, and the fees and expenses (or salary and benefits) of the instructor.

**Indirect costs** include general and administrative overhead.

**Participant costs** include the salaries and benefits of the trainees during their absence from work (to reflect the reality that they aren't doing their jobs while they're being trained) as well as the temporary workers you hire to replace them or, in the absence of such temporary workers, the lost productivity you incur by their jobs not getting done.

## A Hypothetical Case

For a hypothetical case, say you decide to train three network support professionals on a two-day course to learn the essentials of cloud computing as a step toward their certification exam. Licensing the course costs \$30 per student. You will send them to a location 10 miles from their office, and you will hire a freelance instructor to deliver the training. You will need to furnish the instructor's computer. The course does not require specific software for the students, but you lend them tablets so they can browse the Internet as part of the course activities.

### Hypothetical Cost of 2-Day Training Session For Three Students

Course licensing (3 @ \$30) -----	\$90
Freelance instructor's fee (2 days @ \$800) -----	\$1,600
Instructor computer system rental (1 week @ \$100) -----	\$100
Other instructor expenses -----	\$100
Student tablet "rental" (3 @ \$10) -----	\$30
Student travel (60 person-miles @ \$.50) -----	\$30
Training center fee (2 days @ \$100) -----	\$200

Student salaries & benefits (6 student-days @ \$350) -----	\$2,100
Overhead (15% of student salaries & benefits) -----	\$315
Lost productivity (6 student-days @ \$200) -----	\$1,200
<b>Total cost of training -----</b>	<b>\$5,765</b>

The accuracy of these numbers is less important than seeing how quickly they add up when all the costs of training are included. Getting new information into the heads of learners turns out to be an expensive proposition.

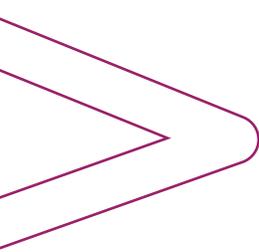
If that final line, lost productivity, looks high at \$1,200, consider what it represents. When you take employees off their regular jobs for training, unless you hire temporary workers (which may bring a host of other problems) to replace them, their jobs don't get done. Presuming their work has been contributing to the company's bottom line, that means there's a cost in lost business due to the employees' absence. If you simply allocate their work to other employees during their absence, chances are good you are giving the work to people who aren't quite as familiar with it, meaning it will take longer (which is another way of saying it costs more) or will be performed with more errors (another way of saying it costs more). In the end, \$200 per student-day may be an underestimate for this cost. This cost applies to eLearning as well as instructor-led training. You may have no travel expenses with eLearning, since trainees can do it at their desks, but you have the same lost productivity cost because a student engaged in eLearning is absent from the job the same as if they were off-site.

Lost productivity is a complicated question. A seriously underskilled or poorly performing employee can actually impose additional costs on a process by introducing errors, the need for rework, or the need for help from others. In some cases, you may actually be able to reduce costs by getting such an employee off-site for a couple days' training. But at some point, we need to limit complications for the sake of discussion, even while recognizing that extreme cases often undermine any argument.

When you spend this much on training and it turns out to be ineffective, there are even more costs. Training an employee to do a job that the employee cannot then do effectively (because the training wasn't optimal) has a significant cost in employee morale. In addition, when trained employees have difficulty performing jobs they were trained to do, there is an unquantifiable cost in the organization's loss of confidence in training. "Training doesn't work" becomes an organizational point of reference, making it more difficult to provide training interventions in the future, leading employees to go into training with lowered expectations and thereby sabotaging training results in a downward spiral of self-fulfilling failure.

Clearly, there are gains to be made (or at least losses to be avoided) by increasing learning retention and training effectiveness.

Remember, you lose new information most rapidly right after you have acquired it. Whether you lose two-thirds on the first day, at a cost (in our example) of \$3,804.90, or 90% after three weeks at a cost of \$5,188.50, it seems clear that there is an opportunity in a conventional training event to substantially improve the return on our training investment by reducing the loss.



## Memory Aids

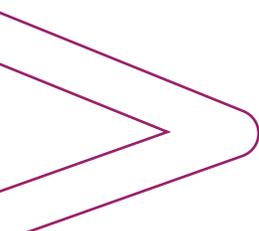
Reducing the loss of the forgetting curve is another way of strengthening learning retention. What are the prospects for strengthening retention? One way to strengthen retention is mnemonics. Mnemonics are verses, acronyms, or memorable phrases that are easier to remember than the abstract material they represent. Most people, for example, can only remember the number of days in the calendar months by reciting "Thirty days hath September..." rather than recalling a table listing month names and numbers of days.

It's difficult for many of us to remember the order of operations in mathematics unless we know the mnemonic "please excuse my dear Aunt Sally," which can stand

in for parentheses, exponents, multiply, divide, add, and subtract. All electronic spreadsheets use the same order, by the way.

Mnemonics are not unfamiliar to IT professionals. Assembly languages use mnemonics for commands, such as “MOV” for “move” or “NOP” for “no operation.” Higher level programming languages are even more obviously mnemonic. The C programming language uses expressions like “if,” “else,” and “goto” to represent operations that are exactly what they sound like. In HTML, the tag for image is “IMG,” and the formatting tag for indented text is “BLOCKQUOTE.”

Mnemonics are often easy to remember, and they must have seemed obvious to the authors of programming languages. But creating them for a subject that needs to be mastered by learners is labor-intensive. They may be worth the effort. Generations of research has shown people can learn faster and more permanently with mnemonics than without them. They are most useful for lists and collections, but there are a lot of things in business training that can be rendered as lists and collections: steps in a process, types of operations, and data types, to name a few.

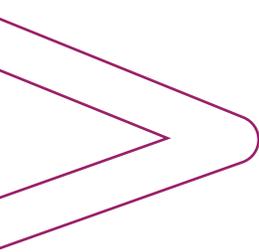


## The Role of Meaning in Memory

As Ebbinghaus understood when he created his lists of nonsense words, learning abstract content is the purest test of memory strength. This is because abstract content, on first encounter, has no meaning. Mnemonics allow the brain to give abstract material meaning, even if the meaning is silly.

Another way abstract material has meaning is by relating to what learners already know. As Ebbinghaus originally suggested, new information will stick better in the learner’s mind if it relates to information that is already there. This suggests that retention rates can be increased by planning a training path for each learner. If you are able to make sure that new training builds on previous training, learners should master the new material faster, and it should stick with them better. That is certainly an approach worth trying.

Planning individual learning paths takes time, but the payoff can be significant. Be sure to evaluate the learners to establish baselines, then take a hard look at content to understand what you need to present to learners in order for new material to relate to existing knowledge and skills.



## Learning Reinforcement

By far, the most easily managed method of increasing retention is learning reinforcement. If, as Ebbinghaus suggested, the greatest information loss is in the first 20 minutes and it continues at a high rate for the first 24 hours, then acting early (even during the training event itself) and offering students tools for post-class support holds a great deal of possibility for keeping the information through reinforcement.

At Logical Operations, our 30 years' experience designing professional curriculum has taught us a lot about effective reinforcement strategies, and has driven us to develop the CHOICE digital platform. CHOICE is an integrated learning platform that helps extend expert-facilitated training beyond the classroom. It provides the student with an immersive, adaptable learning environment that can be accessed anytime, anywhere, on any device. There are a great many reinforcement strategies built into CHOICE.

CHOICE learning activities are progressive. Tasks that students learn early on are repeatedly performed in subsequent activities and practice labs. CHOICE removes scaffolding as the course progresses. Early on, we provide a lot of guidance. As students gain experience with a particular task, we provide less guidance. Activities are situated in real-world contexts to support transfer. By providing real-world context, we help students understand the significance of the skill, which enables them to connect it with their existing knowledge.

CHOICE also provides students with numerous materials, such as a manual and student data files, that help students practice and review what they covered in class. In addition to notes and documentation, Logical Operations courses document every

step in activities, so students can work through the activities again, on their own, if they want to.

**Social learning.** Since the work of psychologist Albert Bandura in the 1960s, we have understood the importance of the social context to learning. People learn most efficiently when they can see the desired learning being modeled by someone else and when they are communicating with others who can promote their self-efficacy (i.e., their belief that they are capable of learning).

On the CHOICE platform, social learning is as close as a tap on the “Collaborate” tile. This tile leads students to a special LinkedIn website, where they can find forum-style discussions with their classmates, webinars, polls, and direct messaging with other participants. To get an idea of the power of the social context, think back to the last time you were in a classroom and did not understand some point made by the instructor. Your first reaction was probably to look at the person sitting next to you to see if they understood. And that bit of communication helped you to decide on your next course of action: ignore the point as unimportant, ask the instructor for clarification, or whisper a question to your neighbor. These kinds of decision occur constantly in a learning experience. Social context helps learners make them. It’s the reason graduate students spontaneously organize study groups.

Logical Operations also employs social learning with a “synchronized swim” approach to activities. We design the activities so that the instructor (with the support of the manual’s precise documentation) guides students through them step-by-step, modeling correct performance as students follow closely behind. As students gain experience, we provide less guidance – to the point that students perform practice labs completely on their own.

Social learning can provide the reinforcement that helps to reduce or minimize information loss.

**Video tutorials.** Video has been used for education at least since the middle of the twentieth century (previously as film). Recruiting an additional cognitive “channel” (i.e., the visual) can increase the amount of information in a student’s short-term memory and improve the chances of retention.

On the CHOICE platform, video tutorials are always accessible at the “LearnTO” tile. As soon as he or she taps on the tile, the student is given a list of brief (average three minutes’ running time) presentations on self-contained topics, such as navigating an application’s interface, making documents secure, or using particular features. These tutorials feature a voiceover and animated screen shots and other graphics so the student can see concrete illustrations of concepts and procedures as they are described in the narration.

Such brief, self-contained video tutorials can be used in a number of ways. They can allow the instructor to park useful but noncritical instruction out of the main flow of the training to help minimize confusion and overload. The student can be told to view the videos when they are needed. If they are used for more critical topics, they can be used as another learning style pathway aimed at students who benefit from that learning style or as reinforcement of other instructional strategies. And finally, they can be used as refreshers that students can call on when needed on the job.

**Job aids.** Students don’t need to learn everything. If a skill can be reduced to a reference card or a checklist, training can be made more effective and even less intimidating to students if the students are simply given job aids and briefly taught how to use them. This is a far more effective strategy than drill and memorization. It also supports more effective job performance, since it’s possible to forget a step in a complex process no matter how well you know it. But if the step is on the checklist, then it will never be lost. You can show a student a procedure for the purpose of basic familiarity and then supply a checklist to use on the job.

The science of checklists has bloomed in recent years, especially in high-stakes

situations. Based on the preflight checklist used in aviation, there are now surgical safety checklists, software engineering checklists, civil litigation checklists, and even investing checklists.

With CHOICE, nearly every topic in a course is distilled into a checklist. The student can access these lists with the “Checklist” tile. Each of the main topics has its own tile, and tapping that tile brings the student to a page of more tiles, each leading to a “How To” or “Guidelines” collapsible checklist that gives the student guidance for the procedures or best practices that help the student achieve that topic’s objective.

**Newsletters.** CHOICE allows the organization to add a newsletter that will provide students with subsequent updates, refreshers, quizzes, and news that keeps them engaged and thinking about the skills they have acquired. This helps reinforce student learning, but it also allows you to stretch the students and expand their learning after the training event.

Newsletters are an excellent way to keep students engaged with the subject matter, and they also build community and make use of the social learning that is so effective.

**Virtual labs.** CHOICE also allows organizations to add virtual labs, which are active software environments where students can perform hands-on exercises like they would in real-world situations. By tapping on the “LogicalLABS” tile, students get access to a safe sandbox environment where they are able to practice the kinds of operations they need to do in their own jobs without needing access to the software or fearing that they will disrupt their company’s network. These labs require no setup on your end and are available for six months after the class.

Ebbinghaus’s forgetting curve may not be accurate for your organization. Your learners may have better memories than Ebbinghaus did. And your learning content is certainly more engaging than lists of nonsense words. Nevertheless, it can be a

difficult and expensive proposition to get new knowledge and skills into the heads of learners, and you can't afford to lose resources or effort in the process. Make certain your training courses are designed to reinforce learning early and often.

For information training, consider CHOICE. It's highly effective instructor-led training with the reinforcement and reinforcement strategies built in. Learn more at [LogicalOperations.com](http://LogicalOperations.com).