The Science of Learning

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Introduction

How the Science of Learning Improves Training Outcomes and Why It’s Needed

The science of learning (or learning sciences) is an interdisciplinary field of study that examines how people learn and how the learning and development (L&D) function can improve training.

The reason for using the science of learning is clear: Just like any professional, it is our job to use the science in our field to improve outcomes. For L&D professionals, this means improving impact, reducing waste, and increasing the speed at which people in the workplace gain critical knowledge, skills, and abilities. It helps us optimize what people do on the job and how organizations perform. The science of learning is the core of our expertise.

I believe learning sciences are more important today than ever to L&D. This is in part because workplaces are increasingly knowledge-intensive and workplace knowledge is quickly and constantly changing. Consequently, people need to be able to learn faster on the job, and traditional means of learning often aren’t able to keep up with this new demand.

Today’s Skills Require Science of Learning Knowledge

This section will help you understand the nature of this new workplace knowledge landscape, and what kinds of L&D expertise are needed to help people learn.

As Autor and Price (2013) explain, routine workplace tasks (do A when B happens), the kind that can be taught through typical training, are on the decline. Skill demands in today’s modern workplace are increasingly leaning toward more analytical and soft skills, including interpersonal, nonroutine, and cognitive skills.

For example, today’s accountant spends more time unraveling complex tax problems and less time calculating taxes (her software program can do the bulk of this task). In other words, today’s skills require greater ability to problem solve, which in turn requires greater levels of expertise.

While business leaders have recognized this skills gap, too many don’t understand how to close it and thus are asking for the wrong training solutions. L&D professionals need to help them see how having the right level of learning expertise affects the bottom line. This is where the science of learning, rather than training fads, makes all the difference.
Science of Learning Foundations
The next five chapters discuss some foundational aspects of the science of learning. For example, “What’s the Point of Instruction?” explains why instruction is critical, despite the fact that people learn on their own, all the time. And it discusses the gap between knowledge and performance: Is knowledge enough? If not, what is?

How do we know if people have learned? What can we take as evidence of learning? How can we determine if the instruction itself is any good? These are the topics up for debate in “Can We Really Assess Learning?” and “Should We Measure Learners or Training?”

In “The Case for Less” we consider how much to include in training and determine that the answer is almost always less. Why is it so important not to include the kitchen sink in every course? And as long as we’re talking about important things to consider when building instruction, here’s another one: People aren’t blank sheets. I elaborate on that point in “Why You Need to Know What Your Learners Know.”

What the Research Tells Us About Best Training Outcomes
In this section, we dig into the research paper “The Science of Training and Development in Organizations: What Matters in Practice” (Salas et al. 2012), which used meta-analyses to seek ways to design, deliver, and implement training to get the best outcomes possible. I split the review of the paper into three posts so I could discuss what the authors found to be the most critical practices before, during, and after training. The good news is the study found that “(a) training works, and (b) the way training is designed, delivered, and implemented matters.”

The research clearly shows that the science of learning (b) helps training work (a). For example, which specific pretraining actions have been shown by research to result in the best training effectiveness outcomes? I discuss this in “The Latest Research on Needs Analysis and Learning Climate.”

The same goes for most critical actions during training, which I discuss in the next chapter. Additionally, do you know what can happen after training to ruin training outcomes, or what questions business leaders should be asking about training? Find the answers in “What Happens After Training?”

Salas’ research is a gift, because it tells us what we need to know to get our best outcomes from training. However, we will need to get business leaders on board; they are used to “business as usual” and that is often not such a good situation at all.

Wrap-Up
In “Key Learning Science Concepts and How to Apply Them,” I highlight some of the most critical concepts from each chapter to discuss how to apply them in most work settings.
If you made it this far, consider yourself a learning geek; you’re to be commended for wanting to improve organizational learning. I recommend that you purchase a copy of The Science of Learning: Examining the Use of Evidence-Based Approaches, my recent whitepaper on the science of learning in organizations. It discusses how science of learning leaders and organizational learning leaders view the need for using science of learning foundational concepts in organizations, and includes a list of resources recommended for taking your science of learning knowledge further.

References

Section 1

Today’s Skills Require Science of Learning Knowledge
Consider this: An organization’s capabilities—all the processes, technologies, and tools—are useless without the skills and abilities (which require learning) that people and their collaborative efforts provide. It is through learning that we become involved in everything that we do. This is the science of learning at work (pun intended).

Currently, there is a surge in interest in how we learn, which makes sense in light of today’s increasingly knowledge-heavy workplace. Learning truly is the essence of human capital. Trendy words and phrases aside, learning is what people do well. In other words, humans are learning machines.

What Is the Science of Learning?
The science of learning is an interdisciplinary field of study that examines how people learn, and how the L&D field can improve learning and instruction. Some of its subsets include:
- brain changes caused by learning (neuroscience of learning).
- effective use of technological tools in learning (educational technology).
- interdisciplinary scientific study of the mind and its processes (cognitive science).
- social interaction using a computer or through the Internet (computer-supported collaborative learning).
- intelligence exhibited by machines or software (artificial intelligence). This includes machine learning—algorithms that learn from data and can make predictions and decisions.

Basically, L&D practitioners want to know how they can use the science of learning to improve learning in their organizations.

Here’s the good and bad news: The study of the science of learning covers a wide expanse, but it is almost too wide for anyone to keep up with. That’s where ATD’s Science of Learning Community of Practice can help. Our goal is to focus on and make sense of the foundations of the science of learning—in language that is easy to understand—so that those working in L&D can apply it to today’s learning problems.
Learning Problems With Knowledge Work

The time when people had to deal with far less information on the job is long past. In the Information Age, technical workers (which define a rather large number of people, including many in our field) seem to benefit most from high-paying jobs. We expect nearly all technical workers to multi-task (even though the ability to multitask is a myth), and to work using multiple devices wherever they are, even at home. We also assume that most people, places, and processes will use the Internet.

Many agree to work like this because no cultural and social norms have developed around working in this era. And recent economic problems have only intensified these pressures.

We’ve seen comparable changes at the organization level. For example, many hiring and scheduling processes are less personal and have moved online. Likewise, there is a movement to self-service learning inside organizations as traditional learning functions struggle with responding quickly to business needs or helping workers prepare for future job requirements.

If that doesn’t ping your radar, it should. Indeed, our field is changing just like other job functions throughout the organization.

Consider self-service learning. It puts workers in charge of their development. They can develop and maintain their own learning plans. They can potentially call on books, online courses, MOOCs (massive open online courses), and others resources. But do workers really know what they need better than we do?

Here are some of the questions that the science of learning needs to help us answer:

• How is self-service learning working among those who use it?
• What learning approaches work in this new way of working?
• What is the best way to help workers learn under these circumstances?
• How are technically oriented workers handling the need to keep up with continually changing job needs?
• How are decreasing skills intersecting with increasing skill needs?
Are We Doing the Right Things?

Currently, corporate learning and development (L&D) is still skewed heavily toward building courses and content, but this approach is not really in sync with the exponential rate of knowledge change and today’s knowledge-heavy work processes—or the instructional “piecework” L&D provides. Consequently, L&D is dangerously close to becoming irrelevant in many organizations.

The Knowledge Doubling Curve

In the early 1980s, futurist and writer R. Buckminster Fuller described a Knowledge Doubling Curve, noting the changing rate of growth in knowledge. He noted that knowledge doubled approximately every century before 1900, but doubled every 25 years at the end of World War II. Today the growth of knowledge is exponential.

Figure 2-1. The Knowledge Doubling Curve

Different types of knowledge grow at different rates. However, on average, knowledge is doubling close to yearly, and the rate of growth is increasing even faster. This rate of knowledge growth has far-reaching implications for supporting learning in the workplace. The way we currently build instructional content may be adding to the problem—not helping it. Ask people if the training we provide is valuable or helpful, and the answer is usually no.

Jane Hart, the founder of the Centre for Learning & Performance Technologies, has asked more than 3,500 people to rate the importance (value) of 10 typical learning methods used in the workplace (Figure 1-2).
According to the data, company training/e-learning (10) is the lowest-valued way to learn at work, whereas knowledge sharing within your team (1) is the most valued. These data raise the question: What are the implications for training organizations and L&D professionals?

Typical training processes do not work for most of the tasks that people must accomplish in today’s workplace. What people do for their jobs is no longer fixed or stable. (And if it is, automation will likely become involved in the future.) Previously, rapid skill change was reserved mainly for senior-level jobs, but now even lower-level jobs require regular reskilling as people learn new systems, new processes, new techniques, and so forth. Tasks that still require human thinking but don’t require regular reskilling often offer low wages and minimal growth potential.

Employee Skills Gap
As if this situation isn’t challenging enough, research shows that many employees enter the workforce missing major skills they need, including technical skills, communication skills, and writing skills. What’s more, by the time most people complete college, a fair amount of what they have learned in their major is outdated. That’s how fast information in most fields is growing.
Many jobs that exist today didn’t even exist 20 years ago, such as app designer, user experience analyst, social media specialist, SEO specialist, data scientist, and wind farm engineer. What jobs are being created as you read this?

Clearly, there isn’t a way to train for future jobs. We must, however, prepare people workers to have the skills and mindset to continually learn—and be those people ourselves.

L&D Skills Gap
This brings us to the skills gap in L&D. A critical skill for our field is to know what works to help people and organizations become more effective and efficient at continually learning and reskilling. Fortunately, the science of learning tells us a great deal, yet many practitioners still heavily rely on traditional training and practices. These learning approaches may have worked for jobs that were fixed and stable, but they don’t work for today’s jobs.

People need to control their own learning when they have to learn continually. Jane Hart’s study shows that this is exactly what is happening. There’s simply no time to wait for L&D. If we don’t want to become dinosaurs, we can’t simply rely on e-learning; we must understand how to support rapid knowledge and skill adoption.

Ability to Continually Learn
When people need to continually build skills and learn as they go, L&D and top-down stakeholders rarely understand their learning needs. As a result, these workers are forced to take their learning needs into their own hands. To help understand this situation, Jay Cross (2007) describes a “learning mixer,” which shows seven dimensions of learner-controlled (informal) learning: control, delivery, duration, content, timing, author, and time to develop.

As the mixer slides from formal to informal learning, these dimensions change. For example, formal learning content is something that L&D professionals build, delivered through in-class training or a learning management system. It is learning that is controlled by the L&D team (or other stakeholders) and pushed onto people. Yet as learning content gets more informal, it becomes more self-directed, consisting of peer-to-peer conversations that may last only minutes. Learners are pulling the information they need from a variety of sources, when they need. When people need to continually build skills and learn as they go, L&D and top-down stakeholders rarely understand their learning needs. As a result, these workers are forced to take their learning needs into their own hands.

Moving Forward
Many people are floundering in today’s challenging corporate learning environment, and we need to help. In the chapters that follow, I will discuss what helps people learn better and adapt quickly under these demanding conditions—especially since the educational system doesn’t seem to be keeping up with meeting workplace demands.
Resources
These employment skills references will help you understand the situation we are in and why I believe our role is under extreme pressure to change or become irrelevant.


Learning Sciences and the Changing Nature of Work

Welcome to the new world of work. Do you know people who can no longer find work (or do the work they used to do) because their job has radically changed?

To emphasize how much jobs are changing, consider the number of jobs that didn’t exist five years ago. Indeed, due to the rate of knowledge change in many fields, most jobs are rapidly evolving—with little end of change in sight.

In the previous chapter, I discussed the impact of the knowledge-doubling curve on the workplace. This rate of change in knowledge necessitates changes in supporting jobs and work. How could it not, really? Still, many people in the L&D field are treating work like it is 1980—or even 1950.

Do Workers Have Adequate Skills?

ATD defines a skills gap as a significant breach between an organization’s current capabilities and the skills needed to achieve its goals and meet customer demands. It is the point at which an organization may not be able to grow or remain competitive because it cannot fill critical jobs with employees who have the right knowledge, skills, and abilities.

Unfortunately, Bridging the Skills Gap reports that 84 percent of respondents to the 2015 ATD Skills Gap Survey said there is a definite skills gap in their organizations, and more than half (56 percent) noted that the skills of the current workforce do not match changes in company strategy, goals, markets, or business models. In addition, a lack of requisite skills when promoting internal candidates for certain types of jobs is a problem for 48 percent of respondents, and 45 percent said there are too few qualified candidates when hiring for certain types of jobs.

These data correspond with statistics and comparisons from the Organisation for Economic Cooperation and Development (OECD), an international forum for comparing economic data. Specifically, OECD Skills Outlook 2013: First Results From the Survey of Adult Skills provides insights into the existing availability of key workplace skills, including literacy, numeracy, and problem solving in technology-rich environments. The OECD report clearly states that skills are one of the largest and most important factors concerning an individual’s life chances. What’s more, companies without adequately skilled workers can’t compete in the world marketplace.

OECD found that most of the workers in the United States and other countries, such as Germany, France, Spain, and the United Kingdom, are below average in the key workplace skills measured (see Figure 0.2 in the report). This is especially troubling because job demands are increasing. In addition, OECD found that the countries with above-average scores not only have more workers with skills, but also those workers have the highest skill levels. What does this mean for countries, companies, and individuals without these key skills and those who fall into lower-level proficiencies?
The OECD survey also reported that 7 to 27 percent of adults described very little experience and confidence with computers. They were unable to do simple things like use a mouse, solve problems, and find files. The survey found that Nordic countries and the Netherlands were more successful than other countries in ensuring that adults had computer skills.

**Using Learning Sciences to Bridge the Skills Gap**

Not having adequate work skills is a system failure; it means that companies and people are failing. We can continue to do things as we are doing them, knowing that knowledge is increasing and the bar keeps rising, or we can decide it’s time to be the change our organizations need.
Section II
Science of Learning Foundations
What’s the Point of Instruction?

Marla designs help documents for the software applications her company produces. She sits across from Sean, who develops monthly training webinars. Marla would like to move up to building instruction like Sean does, but Sean tells Marla that he thinks that the work that Marla does is actually more useful for the company’s users.

We could argue the merits of documentation versus training, but there’s always the question of what each user needs at any given moment. Context is everything.

The science of learning works to understand how we learn and how we can improve learning and instruction. But to be fair, humans have been learning on their own since, well, forever. For instance, if Corinne wants to know how to do something, she often asks the person next to her and then gets on with her job. Yan mentors Morey and they meet most Tuesday afternoons. Marlena uses self-study materials and is going to take a certification exam in less than three weeks.

So why do numerous disciplines (neuroscience, psychology, education, computer science, and others) expend enormous energy and resources to figure out how we learn and how to best build instruction? Can’t we just leave people alone?

We Learn All the Time

An interesting study by D.W. Livingstone (2001) shows that the majority of workplace learning happens not in formal settings but in informal ones. Numerous studies, including Livingstone’s, show informal learning as a proportion of all workplace learning at greater than 70 percent. If you haven’t already looked into informal learning, you should, because training professionals need to understand it more. Saul Carliner’s book on the subject, Informal Learning Basics, is a good primer, as are writings by Jay Cross.

You might think that the definitions of learning and instruction are self-explanatory, but they aren’t that simple. And they help us see exactly what we are trying to do.

Learning, Defined

There are many definitions of learning. A favorite comes from De Houwer, Barnes-Holmes, and Moors (2013): “Learning is changes in behavior that result from experience.”

Some definitions don’t require changes in behavior, only changes in knowledge. For me, this doesn’t cut it. If you can’t do what you are learning, the learning isn’t quite cooked yet. For example, if you can’t use what you are learning, you are on your way but not there yet.
Applied learning requires knowledge and experience with the range of possibilities, of course. As my colleague Catherine Lombardozzi reminded me, people need deep knowledge, not only to follow a script. So if a customer service agent is following a script for handling returns, but she cannot handle the variety of returns, she only knows how to follow a script. She hasn’t really learned the whole returns process.

One definition of learning discusses how learning requires the ability to correct errors. Now this is truly deep learning. One of the biggest problems people have is correcting things that go wrong. Misconceptions and mistakes are a big problem in learning. So when defining learning, we may want to determine how far into expertise we are talking about. Should the learners be proficient (competent or skilled), or should they be experts?

Why Build Instruction?
People can and do learn on their own. But we also know that when there are very specific things we want people to be able to do, there are efficient ways to help them. If learning occurs when we interact with our environment, then instruction is the creation of special environments specifically to promote learning.

Richard Mayer, professor of psychology at the University of California, in his book *Applying the Science of Learning*, reminds us that we are trying to change behavior as a result of instruction. There are methods to do so that are more effective than others (that’s what the science of learning and instruction are about).

This view has very far reaching implications. It means that if we are building instruction, we have to affect what people do. That’s a high bar. Although it may not be practical to expect everything we do to reach that high bar, we ought to reach it often.

That leads to two questions that we should ask ourselves:

1. How do we infer (assume changes in) learning after instruction?
2. How do we determine if the change has made it from instruction to the job?

References


Can We Really Assess Learning?

To assess something, we need to know what we want to measure and how to measure it. For example, there are specific ways to measure points scored in different team sports, how fast different objects are moving, and the amount of liquids, solids, and weights used in cooking.

How do we measure learning? In “What’s the Point on Instruction?,” I defined learning as “changes in behavior that result from experience.”

To assess learning, we need to know how to measure the changes in behavior that are most important to us. For example, what do you measure when you need to assess the learning experience of a class on using Gmail? One likely measurement could be if the learners know how to sign up for and use a Gmail account to send and receive email.

People can and do learn on their own. But when we want to help people learn, we build instruction—special environments specifically to promote learning. So the obvious reason for assessing learning is to see if the special environment we built changed what the learner is doing as a result of what we did.

Eek! Research shows that we don’t tend to find out if the training had an impact on what people are doing on the job or in the real world. Rather, we tend to assess only what they can recall from the training. That means that we are not regularly doing what most professionals do: Assess their work.

Different Ways to Assess Learning

Testing with recall questions about the content isn’t much of an assessment. Here are three examples of real-life learning assessments:

- Chen demonstrates that he is a good candidate to move into the vacant account executive position through his sophisticated product knowledge and excellent dealings with clients.

- Nola creates unique jewelry out of twisted strands of sterling silver. Her students anxiously await her new classes.

- Kia helps Penn with the more difficult statistics coursework for their classes. Both are hoping to move into more advanced and lucrative positions within the company.

All of these people learned their craft through informal and formal learning. Stop for a moment and consider what they might have done to improve their expertise.

Traditionally, educational classroom assessment provides grades and placements, helps determine where teachers need to give additional support, finds where to address misunderstandings, and targets feedback.

Too often, in traditional corporate classroom and online learning, we don’t determine if people need more support or resolve misunderstandings, so it may become difficult for people to continue
learning. Instructional feedback is often too shallow. Likewise, too many designers don’t realize that feedback is also meant to be instruction!

**Direct and Indirect Inferences About Learning**

We make inferences about learning by collecting direct or indirect evidence. Direct evidence includes samples of what people do, which tends to be the strongest evidence. Chen’s answers to product knowledge questions are direct evidence, as are Kia’s statistics skills. We can’t measure everything directly, such as perceptions or feelings.

Indirect evidence includes perceptions and rankings. These can come from supervisors, peers, customers, the learner, and others. For example, we might ask Kia if Penn seems to be struggling with statistics. A survey of Nola’s teaching skills by her students would be indirect evidence (observations of her classes would be more direct). Indirect evidence tends to be less strong than direct evidence because it’s more subjective.

An ideal assessment might combine direct and indirect measures. We call this triangulation of assessment evidence. Table 5-1 provides a list of possible direct and indirect evidence of learning. There are more types of evidence, but these are the main types for training.

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<th><strong>TABLE 5-1. DIRECT AND INDIRECT EVIDENCE OF LEARNING</strong></th>
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<tr>
<td><strong>Direct Assessment</strong></td>
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<tr>
<td>• Scenario questions results</td>
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<tr>
<td>• Observations</td>
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<tr>
<td>• Actual performance (simulation)</td>
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<tr>
<td>• Actual performance (on the job)</td>
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<tr>
<td>• Work products (such as reports)</td>
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Measuring learning is difficult because we have to first agree on what exactly we are measuring. And we could spend hours arguing even the definition of learning! One thing is certain: We are not measuring direct evidence such as speed or weight; we are measuring the outcome of the evidence, something that stands in for the evidence.

Triangulating data (by looking at direct and indirect evidence) is often worthwhile. It increases the chance that you are getting a decent picture of what is happening. It’s hard to reduce this picture to a single number unless you are statistically proficient, and even then you are reducing a complex initiative to a number. I’m not usually a fan of doing that because you often lose sight of what that number really represents. I recommend reading *The Success Case Method* by Robert Brinkerhoff for evaluating the success of a training initiative.
What Is the Purpose of Assessment?
We may believe that assessment just informs learners of how they are doing, but that’s only one of many reasons for assessment. In the next chapter, I’ll discuss other reasons for assessment—and why leaving them out actually leaves L&D practitioners in peril.

References


In the previous chapter, we discussed how the typical training assessments we give after training, such as questions that tell us whether people can recall the content, aren’t much of an assessment at all. Do we really care if people can remember the name of the document? Or do we want to know something else?

Well, that’s the thing: First we have to figure out what we want to know. Take a look at the following questions. Which of these do you or your L&D organization need the answers to? What will you do with the information? If the answer is nothing, you probably don’t need to ask the question.

1. Did people achieve the intended learning outcomes?
2. Does the instruction have defects, unclear points, or other problems?
3. How do people attain their own learning needs?
4. How can we support individuals’, departments’, and the organization’s learning needs?
5. How do people use what they learned from a learning program?
6. In what ways does instruction affect the organization?

These are just a few of the evaluation and assessment questions that L&D practitioners might want to answer. Let’s talk about a few basic ways to answer them.

Assessment

Assessment is the process of collecting data about individual knowledge and skills in order to draw conclusions about the training initiative, such as if people achieved the intended learning outcomes (question 1).

Testing is one method of assessment, but recall questions aren’t great because they don’t provide useful information. We can, however, use data from tests (item analysis) to help us determine what’s wrong with the instruction or the test. Alternatively, we can ask people to tell us what isn’t clear or isn’t working (question 2).

L&D practitioners often use flawed assessments and rarely check to see whether instruction is problematic. Look around and you’ll see poorly written assessment items and casually set cutoff scores. Depending on the context, this could be a legal nightmare waiting to happen. However, if you have good test-item writers, can justify your cutoff score, and want to determine the answer to question 1 solely through test questions, that’s an acceptable approach. (Sometimes we just need to know that people read something, so a checkbox will do.)
Rather than question 1, perhaps we are better off spending our limited time with questions 5 and 6. But that’s more about evaluation than assessment.

**Evaluation**

Evaluation is analyzing assessment and other data to draw conclusions about the value of what we do.

One of the most popular evaluation models in training is Kirkpatrick’s four levels of evaluation: reaction (Level 1), learning (Level 2), on-the-job performance (Level 3), and business results (Level 4). The Kirkpatrick model has been the primary model for training evaluation for many years because it provides a systematic way to look at training outcomes. It has made extraordinarily valuable contributions to the field.

Reid Bates (2004), a professor of human resource and leadership development at Louisiana State University, wrote that any good evaluation framework must help us answer these questions:

- Was the program effective?
- What can we do to improve it?

Bates says flaws in the Kirkpatrick evaluation model create problems when attempting to answer those questions. Those flaws include creating the perception that reaction measures can stand in for training outcomes (they can’t), the levels are causally linked (research shows they aren’t), and each level provides more important data than the previous level (not necessarily).

Business and financial people often scoff at the reliability of training return on investment because it’s impossible to account for all of the variables that affect training. Bates discusses this in his paper, and says it is yet another problem with Level 4 measures.

So, how do we answer questions 5 and 6? I discussed some strategies in the last chapter; again, Robert Brinkerhoff provides some advice in *The Success Case Method*. The processes he discusses are not difficult, and put us in touch with key stakeholders of our work. Essentially, his model tells us how to identify the most and least successful trainees and conduct interviews with selected samples to gain critical information about the specific nature and scope of impact from training and the improvements that are needed.

Remember: We find time for effective assessment evaluation by letting go of tasks that don’t need doing. Stop building courses when a job aid or PDF will absolutely do. When no one cares about assessment information, but you need to know if someone has downloaded or read something, use a checkbox. Measure when it’s truly important.
References


The Case for Less

One of the factors to determine when designing instruction is how much instruction to provide. This isn’t always considered, though, and we often provide too much instruction or not enough. This brief story will emphasize one aspect of this problem:

Joanna, a new hire in food service at the local hospital, is taking an online course in handwashing. The course contains key facts about germs and how handwashing destroys them, but also statistics about handwashing, facts about different types of hand sanitizers, and the history of hospital-acquired infections and how they spread.

The primary message is that feces contain life-threatening germs and that tiny amounts often get onto hands after using the bathroom or handling objects that others have touched. People in the hospital often have compromised immune systems and if they come into contact with these germs, they can get very sick or die. Handwashing can prevent the spread of these germs.

The problem: There is so much other information in the course that Joanna doesn’t get the seriousness of the message. Her main takeaway is that handwashing is a “very old issue.” Joanna passes the quiz but misses the critical message.

Consider people handling the following work tasks:

• Situation A: an accounting clerk in an accounts payable department has a vendor on the phone with a question she doesn’t know the answer to
• Situation B: an armed guard at a secure military facility gate is talking to a driver who is acting aggressively and trying to hand him a wrapped package to deliver
• Situation C: an air traffic controller sees two planes on the screen that will shortly be in each other’s air space.

We often build training as if everyone needs to know everything about everything. And it’s easy to overload working memory and make it so people learn less than we want them to. However, we need to make sure people learn what we need them to learn.

Cognitive Overload

One reason why we need to provide only what people need is explained by cognitive load theory, which states that our brains can only process a certain amount of information at a time. And one of the things that can cause overload is too much information. Figure 7-1 shows the three types of cognitive load.
When Learners Don’t Need to Know Everything
People don’t have unlimited time. Do we need to train the accounting clerk in situation A on every answer to every possible vendor question? Probably not.

How do learners find other information if they need it? They’re probably not going to look in their previous training materials to find the answers they need, so building performance support materials (or having them do it) is key.

But Some Workers Do Need to Know Everything
On the other hand, the workers facing the issues in situations B and C don’t have time to look up or ask someone for the proper response. They need to know what to do in these situations, and how to do it effortlessly—even if these situations don’t happen very often. We call this automaticity.

Automaticity is the ability to do a task effortlessly without any conscious effort or attention. Making something automatic includes accuracy and speed. Automaticity frees the mind to do other things, such as assess the situation, determine what is important, and find alternatives. Benefits of automaticity seem to be consistent across cognitive, perceptual, and motor tasks. But methods for training to automaticity for these different types of tasks are different. And training to automaticity requires a lot of work for the training designer and the learner.

We make fun of rote learning, but in some cases, it’s required—especially when dealing with the
need for automaticity. The alphabet is an example of where rote learning is required to move on to more rote learning for reading proficiency and fluency.

Not many tasks require the kind of automaticity described in situations B and C, but many do require the capability to recall information quickly, such as answering guest questions at a hotel desk while others are waiting or medical staff helping patients and families during pivotal moments. Imogen Casebourne wrote a good Science of Learning Blog post about supporting learning and remembering of this type of information.

References


Why You Need to Know What Your Learners Know

Jan starts her business writing course by asking participants to write an email to persuade the recipient to attend a meeting. Most participants write an email that is too long, and 84.3 percent of the emails have grammatical errors. These results are exactly what Jan expected.

Jan then shares with the group a variety of business emails, and asks them to choose two that they think are most persuasive. Jan asks, “Why are they good?”

“They both quickly explain exactly why I would want to be there,” Katarina answers. Percy adds, “Mine was far too long and twisting. No one would read it or reply.” He quickly sees how this course can help him.

People Aren’t Blank Sheets

We often build instruction as if people are blank sheets of notebook paper on which we are writing. This is a mistake that causes problems on numerous fronts.

Pre-existing knowledge is the foundation to build additional knowledge. Jan’s exercise helps her participants discover pre-existing knowledge in a fun way. It is our job to help learners connect what they know to what they are learning. It is these connections that help learning make sense.

Your courses need to help learners perform three critical actions:

1. Activate directly related, accurate knowledge.

2. Fill in critical, missing knowledge.

3. Fix misconceptions.

For example, in order to teach others to balance a checkbook, we can:

1. Help people activate existing, related knowledge by showing them how balancing a checkbook is very much like how they managed the cash they earned babysitting as a teenager to have enough saved to go out with friends. Let’s say you ask, “How can we do this?” Their answers relate to the process of inputs to and outflows from a checking account.

2. Make sure that there isn’t any missing, critical knowledge by giving them a calculator to do basic addition and subtraction. If there is missing information, we would need to fill in gaps. Ideally, we would have determined this information in advance to know what information needs to be included in the course.

3. Fix misconceptions by letting them know that they don’t need to know advanced math to have a checking account. When such misconceptions exist, they can really interfere with learning.
Why Prior Knowledge Is So Important

Research shows that when we are able to connect what we’re learning to accurate prior knowledge, we learn more and retain that knowledge more easily. That’s because all learning is a refinement of prior knowledge.

The implication is that we need to consider prior knowledge every time we deliver instruction. Doing so makes it much easier for people to learn. For example, if percentages didn’t make sense when you first learned to calculate them, a new lesson on interest rates will fail to make sense or “stick.”

In addition, learners also must be able to access prior knowledge. Sometimes participants have already learned something, but they can’t easily remember it. They may be overwhelmed or afraid. (See chapter 7 on training to automaticity and “Steering Away From Cognitive Load,” Dave Ferguson’s blog post on avoiding too much cognitive load.)

What If Learners Don’t Know Enough?

Consider the following scenario: I know that the best ratio for coffee to water in a French press is one part very course ground coffee to about 14 or 15 parts very hot water (almost boiling). I also know that the brew time is generally about six to seven minutes. Do I know enough to make good coffee in my French press? No.

This is what we call necessary but inadequate declarative knowledge (the basic facts or the “know what”). In this example, I know “what” but I still don’t know “how.” “Know how” is called procedural knowledge. The declarative knowledge I have is accurate, but I still can’t do the task.

Likewise there are times when someone can do the task (he has procedural knowledge), but he doesn’t have the understanding of what he is doing. For instance, have you ever been on the phone troubleshooting a technical problem with someone who is using a script? When you ask her a question, she can’t answer it unless it is in the script.

So when L&D professionals say, “The only thing we care about is performance,” that isn’t exactly right. People need to be able to perform (know how) with understanding (know what) so they have the nimbleness to change their performance as needed.

What If What Learners Know Is Wrong?

Sometimes what people know is simply wrong. For example, there is a popular but erroneous misconception called the equal transit time theory that explains how airplanes fly (aerodynamic lift). Actually, planes fly because the wings force air downward, which forces the wing and the plane upward.

Misconceptions damage further learning and can lead some learners to be resistant to correction. Scientists are still debating how wings work and planes fly. Likewise, L&D folks are still debating learning styles and other learning myths. See “Debunk This,” Will Thalheimer’s blog post refuting such myths as “people remember 10 percent of what they read and 20 percent of what they hear.”
Bottom line: We can’t assume that people actually know what they say they know. We also have to uncover misconceptions and help people replace them with accurate information, especially when misconceptions make further learning difficult.

References

Section III
What the Research Tells Us About Best Training Outcomes
The Latest Research on Needs Analysis and Learning Climate

We previously discussed how knowledge is changing so fast in most fields that it’s difficult for most people to train for a job and then do that same job for any length of time. Jobs change as knowledge changes. The implications for the L&D function are overwhelming.

Unfortunately, L&D isn’t helping the situation. Many L&D teams are simply throwing more information at people in their organizations—more PowerPoints, more e-learning. But by doing this, they become part of the problem. Senior leaders don’t understand how learning works; L&D must.

The best way to solve this problem is to use the science of learning to deliver training programs that help the situation, not hurt it. Luckily, we have a great deal of guidance.

What Works?
In “The Science of Training and Development in Organizations: What Matters in Practice,” Eduardo Salas and his fellow authors (2012) assert that “decisions about what to train, how to train, and how to implement and evaluate training should be informed by the best information science has to offer.” How could we disagree, especially under the current circumstances? And yet they found that too many training departments have relied on fads, not science.

The authors used meta-analyses (statistical methods for contrasting and combining results from multiple research studies) to determine how to best design, deliver, and implement training as effectively as possible.

I thought I’d create a guide to this jam-packed research document and reveal some of the gold nuggets within. I’ll start with some of the definitions used. Then I’ll discuss the initial part of the article, in which they discuss what is needed prior to training in order to have effective training. That’s as far as I’ll get in this chapter. (Did I mention that the research is jam-packed?)

Definitions
Here are the primary definitions, quoted directly from the paper. Anything within square brackets are my own comments.

- Training: planned and systematic activities designed to promote the acquisition of knowledge (i.e., need to know), skills (i.e., need to do), and attitudes (i.e., need to feel). [I’m not sure how much we can, or even should, try to make people feel, but some learning researchers and theorists think we ought to work on changing attitudes.]
- Learning: a process of acquiring new knowledge and behaviors as a result of practice, study, or experience.
• Effective training: when trainees are intentionally provided with pedagogically sound opportunities to learn targeted knowledge, skills, and attitudes . . . through instruction, demonstration, practice, and timely diagnostic feedback about their performance.

• The goal of training: to create sustainable changes in behavior and cognition so that individuals possess the competencies they need to perform a job.

Before Training Occurs
Figure 9-1 is Table 3 from the paper, showing pretraining actions that are most critical to improving training effectiveness. I’ll concentrate on a few of these actions for the rest of this chapter.

Figure 9-1. Checklist of Steps to Take Before Training

<table>
<thead>
<tr>
<th>Step</th>
<th>Actions</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduct training needs analysis</td>
<td>Determine what needs to be trained, who needs to be trained, and what type of organizational system you are dealing with.</td>
<td>Clarifies expected learning outcomes and provides guidance for training design and evaluation. Enhances training effectiveness. Ensures that the training provided will address real job requirements and demands.</td>
</tr>
<tr>
<td>Job–task analysis</td>
<td>Specify work and competency requirements. Examine teamwork demands, if needed. Identify what trainees need to know vs. what trainees need to access. Consider conducting a cognitive task analysis for knowledge-based jobs.</td>
<td>Enables strategic resource-allocation decisions. Identifies how the work environment can support or hinder the training objectives. Clarifies training demand and trainees’ needs. Maximizes benefits of the training by ensuring fit with trainees’ needs.</td>
</tr>
<tr>
<td>Organizational analysis</td>
<td>Examine strategic priorities and the culture, norms, resources, limitations, and support for training. Determine whether policies and procedures in place support training.</td>
<td></td>
</tr>
<tr>
<td>Person analysis</td>
<td>Uncover who needs training and determine what kind of training they need. Determine whether training must be adapted for some learners.</td>
<td></td>
</tr>
<tr>
<td>Prepare learning climate</td>
<td>Schedule training close to when trainees will be able to use on the job what they have learned. Plan to offer refresher training when skill decay cannot be avoided.</td>
<td>Reduces skill decay and atrophy.</td>
</tr>
<tr>
<td>Notify employees</td>
<td>Communicate clear expectations about the training. Describe training as an “opportunity” without overselling. Inform employees about any posttraining follow-up. Communicate the importance of training.</td>
<td>Encourages the right attendees. Ensures trainees enter with appropriate expectations, which enhances readiness and learning.</td>
</tr>
<tr>
<td>Establish attendance policies</td>
<td>Determine whether attendance should be mandatory. Use the mandatory label selectively.</td>
<td>Helps ensure learner motivation and attendance.</td>
</tr>
<tr>
<td>Prepare supervisors and leaders</td>
<td>Prepare supervisors to support their employees and send the right signals about</td>
<td>Enhances employees’ motivation to learn.</td>
</tr>
</tbody>
</table>

Needs Analysis: What’s Needed and Why

The authors found two steps to be especially critical for pretraining effectiveness: needs analysis and preparation of the learning climate. From my own knowledge of the field, many L&D teams don’t do either of these steps very often or with much precision. Could this be one reason for lack of success? Probably yes—ever heard of the phrase, “Measure twice; cut once?” Analysis helps you avoid mistakes before taking action. I know teams are working under deadlines, but they can conduct an analysis of learner needs and the learning climate fairly quickly.

First, the authors clearly explain that it’s important to realize when training is not the right solution. A needs analysis will determine whether a nontraining solution is a better alternative.

Second, they explain, we often ask too few or the wrong questions. Stakeholders (such as jobholders, their supervisors, or a subject matter expert) often don’t know what they need. Likewise, they often don’t know the difference between must-know content and content that a jobholder can simply retrieve as needed. The authors remind us that this distinction is of the utmost importance, because people can only process a certain amount of information at a time. If we ask people to memorize or process more information than necessary, it interferes with learning.

You and I know that this situation (too much irrelevant content) is common with learning. It needs to stop. Who will stop it if not us?

Learning Climate: What’s Needed and Why

On the topic of learning climate, the authors found that expectations about training can and do affect learning. They found that trainees need realistic expectations about the training and must see how training will enhance their work.

How supervisors handle training also matters a great deal. If training is to work, supervisors must be involved in a positive way, including preparing people and reinforcing learning objectives. They must support training in a variety of ways, or the training is much less likely to be useful.

Maintenance of knowledge and skills (what the authors call skill decay) is a serious problem, so training should be scheduled near use. When skill decay is unavoidable—as is the case for infrequently used skills—proficiency practice is needed. However, the authors remind us that most organizations don’t do this unless it is mandated.

Once again, we know that L&D understands the criticality of this situation, but management doesn’t. Therefore, it is our problem to fix.
References


10
What Research Says Matters Most During Training

In the last chapter, I began a discussion of “The Science of Training and Development in Organizations: What Matters in Practice” by Eduardo Salas and fellow authors. This paper tells us, in very clear terms, that “decisions about what to train, how to train, and how to implement and evaluate training should be informed by the best information science has to offer.” The authors used meta-analyses to help us see the best ways to design, deliver, and implement training so our outcomes are as good as possible. The paper also allows us to apply the science of learning to our own organizations.

In the last chapter, I reviewed things I felt were most interesting about what we need to do before training, primarily needs analysis and setting a learning climate. This month, I’ll pick out some of the issues I felt were most important from the meta-analyses about the most effective practices during training.

Figure 10-1 (Table 4 from the research) offers a checklist of steps to take during training to ensure maximum effectiveness.

Individual Characteristics

The authors begin with a discussion of how people bring individual characteristics to the learning environment and how these characteristics influence training outcomes. For instance, self-efficacy is what a person believes about his or her own abilities, and goal-orientation is how a person thinks about, interprets, and behaves in learning environments. Meanwhile, motivation is the effort, interest, and persistence that a person puts into learning.

Because these characteristics significantly influence learning, the top portion of Figure 10-1 lists what the research says L&D practitioners must do to influence these characteristics. The research also discusses how to help people with different orientations to training succeed. For example, it says that those who want to take greater responsibility for their own learning processes should be given that freedom while those who need more structure may need more help. This made me consider how we might facilitate additional mentoring as needed.

Currently, we tend to treat everyone the same, but according to research, this is not the best way to succeed. This makes sense with adults, just as it makes sense with children.
Figure 10-1. Checklist of Steps to Take During Training

<table>
<thead>
<tr>
<th>Step</th>
<th>Actions</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Enable right trainee mindset</td>
<td>Deliver training in a way that builds trainees’ belief in their ability to learn and perform trained skills. Reinforce performance during training.</td>
<td>Enhances motivation and increases perseverance when on the job.</td>
</tr>
<tr>
<td>□ Build self-efficacy</td>
<td></td>
<td>Leads to greater learning.</td>
</tr>
<tr>
<td>□ Promote a learning orientation</td>
<td>Encourage trainees to participate in training to learn rather than to appear capable. If most trainees will not have that orientation, design more structured training experiences.</td>
<td>Leads to learning and positive reactions to learning; may encourage transfer back on the job.</td>
</tr>
<tr>
<td>□ Boost motivation to learn</td>
<td>Engage trainees and build their interest. Ensure that training is perceived as relevant and useful. Show why it benefits them.</td>
<td></td>
</tr>
<tr>
<td>□ Follow appropriate instructional principles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Use a valid training strategy and design</td>
<td>Include these elements in training: provide information, give demonstrations of good/bad behaviors, allow trainees to practice, and give meaningful and diagnostic feedback.</td>
<td>Helps trainees understand and practice the knowledge, skills, and abilities that they need to develop; allows for remediation.</td>
</tr>
<tr>
<td>□ Build in opportunities for trainees to engage in transfer-appropriate processing</td>
<td>Incorporate features that require trainees to engage in the same cognitive processes during training that they will have to in the transfer environment (e.g., sufficient variability and difficulty). Recognize that performance during training does not necessarily reflect trainees' ability to apply what they have learned in the transfer environment.</td>
<td>Equip trainees to be better able to apply what they learned when performing their job.</td>
</tr>
<tr>
<td>□ Promote self-regulation</td>
<td>Maintain trainees' attention and keep them on task by encouraging self-monitoring.</td>
<td>Allows trainees to monitor their progress toward goals; enhances learning.</td>
</tr>
<tr>
<td>□ Incorporate errors into the training</td>
<td>Encourage trainees to make errors during training, but be sure to give guidance on managing and correcting the errors.</td>
<td>Improves transfer of training and equips trainees to deal with challenges on the job.</td>
</tr>
<tr>
<td>□ Use technology-based training wisely</td>
<td>Technology can be beneficial in training, but proceed with caution. Recognize that entertaining trainees is insufficient for return on investment.</td>
<td>Optimizes individual learning.</td>
</tr>
<tr>
<td>□ Use computer-based training (CBT) correctly</td>
<td>Ensure that any CBT is based on sound instructional design, for example, providing trainees with guidance and feedback. Recognize that not all training can be delivered via computer.</td>
<td>Allows for self-paced learning.</td>
</tr>
<tr>
<td>□ Allow user control wisely</td>
<td>Provide sufficient structure and guidance to trainees when allowing them to make decisions about their learning experience.</td>
<td>Allows for individualized training experiences while ensuring trainees have appropriate learning experience.</td>
</tr>
<tr>
<td>□ Use simulation appropriately</td>
<td>Best to train complex and dynamic skills, particularly those that may be dangerous. Ensure the simulation is job relevant, even if it is not identical to the job. The priority should be on psychological fidelity rather than physical fidelity. Build in opportunity for performance diagnosis and feedback. Guide the practice.</td>
<td>Enhances learning and performance; allows trainees to practice dangerous tasks safely.</td>
</tr>
</tbody>
</table>

Training Strategies
A good training strategy, according to the authors, provides correct information, demonstrates desired behaviors, creates adequate practice opportunities, provides good feedback, and allows for remediation. Research tells us that a great deal of learning occurs through practice and feedback components during instruction. So practice must have timely, constructive, actionable, task-focused, and diagnostic feedback. The delivery approach should enhance learning and transfer to the workplace.

Unfortunately, a great deal of e-learning, especially, provides mostly instructional content with minimal practice elements. We often provide poor feedback and little remediation, and the practice elements we provide are not anything like what people find at work. Clearly, L&D practitioners need to rethink what we are doing.

Technology Issues
Some research suggests that training costs are the same for technology-based training as for traditional classroom training. Reductions in training staffing and travel are often offset by investments in technologies. More importantly, not all training needs are best addressed with technology-based training approaches.

One of the failures of technology-based environments is when people are unable to successfully navigate and use high learner-controlled environments. At first glance, this may seem surprising, but recent skills research shows that too many people do not have the digital skills needed for today’s workplace. Salas and the other authors want organizations to examine if these digital environments provide enough structure or guidance for their workers to learn as expected.

Reference
What Happens After Training

This chapter wraps up our look at “The Science of Training and Development in Organizations: What Matters in Practice,” which used meta-analyses to find the best ways to design, deliver, and implement training so performance outcomes are as good as possible.

We’ll complete the discussion by examining what the meta-analyses uncovered about the most effective practices after training.

Why Post-Training Is So Important

My mother-in-law used to say this about cooking: “You put good things in, it’ll taste good.” While this maxim sounds logical, it doesn’t always work in practice. For instance, chocolate and mustard don’t taste good when you mix them together. Likewise, you can ruin good foods by cooking them for too long.

What does this have to do with training? Simply this: Good ingredients don’t ensure good training, and training “tastes” best when L&D pros “cook” it the right way. Certainly, it’s nice when learners earn a good score on a post-instruction test, but it’s inadequate if their performance doesn’t improve. In other words, transfer of training is the ultimate goal.

In their research, Salas and his fellow authors come to the same conclusion. They explain that although organizations spend billions of dollars on training each year, even good training doesn’t always transfer to the workplace. Therefore, they assert that what happens after training “can have as great an impact on training effectiveness as what happens during training.” What’s more, lack of transfer happens for a variety of reasons, but their meta-analyses found that follow-up activities can have a positive impact on this challenge.

Figure 11-1 shows Table 5 from the research, which is a checklist of steps L&D practitioners can take following training experiences to ensure maximum effectiveness.
Support on the Job

The analyses show that the post-training environment has a significant impact on whether training will transfer to the workplace. For example, is the supervisor supportive of the skills covered in the training program? Will the work environment allow people to use these skills? These factors have a huge impact on whether the skills practiced in training continue or die out.

The paper also points to research that shows only 7 to 9 percent of skill acquisition comes from formal training. Instead, leaders (both formal and informal) are key factors in learning, because they greatly influence what people actually do on the job. Think about how people perform where you work and you’ll realize the truth of this statement. The Salas paper states that organizations must
provide tools, training, and support to help these leaders coach others and reinforce desired training as well.

**Debriefing**
The authors also say that organizations can institute debriefing as a powerful tool for reinforcing learning after training. Debriefing enables learners to reflect on the training experience and identify what went well and not so well. In addition, when used after training, debriefing can help workers create performance agreements that tie measurable actions to their performance goals.

**Evaluation**
Training evaluation typically means collecting data to determine whether the training program met learning objectives. The Salas paper provides a good discussion of how best to do this so the organization can determine whether accomplishment of the learning objectives resulted in improved job performance.

**Training, Systems, and the Science of Learning**
“The Science of Training and Development in Organizations: What Matters in Practice” provides a list of important questions that L&D practitioners can ask about training programs—covering both general terms and specific aspects of individual training programs (see Figure 11-2, which is Table 6 from the research).

**Figure 11-2. Key Questions Human Resources Execs, Chief Learning Officers, and**
Business Leaders Should Ask About Training

For training in general throughout the organization or business unit:
   - Have we invested sufficiently and wisely in training and learning-related activities in our organization? How do we know?
   - How clear are we about the competencies we will need in order to compete successfully? How clear are we about where the gaps exist?
   - What have we done to diagnose our organization’s learning environment? What are we doing to make our organization more conducive to learning?
   - What do you need to do to send the right signals to our employees about the importance of training and learning in our organization?
   - How will we know that our overall efforts in training and development have an impact? What evidence do we expect to see?

For a specific training program:
   - What type of training needs analysis have we conducted to ensure we will be training the right things in the optimal way?
   - What training strategy will be employed? How are we incorporating effective instructional design elements (e.g., information, demonstration, practice, and feedback)? How clear are the learning objectives?
   - What are we doing to ensure we adequately engage, motivate, and challenge the trainees (and not simply ensure they are “happy”)?
   - What are we going to do before and after this training to ensure trainees can and will use what they have learned? What are we doing to prepare trainees, remove obstacles on the job, and reinforce and sustain learning?
   - How is any training technology that we plan to use going to enhance learning and help trainees perform their jobs better, and not just look cool?
   - Should we be evaluating this training program? If so, for what purpose (e.g., to make adjustments or decide whether to continue it) and how?


The authors suggest that readers consider the analogy of investing large sums of money, such as retirement funds, into mutual funds without ever researching the fund’s past performance or reviewing how the investment does over time. Doing so would be akin to throwing away your money, right? Similarly, not trying to obtain the best outcomes from your training is irrational. That’s why the paper states that “decisions about what to train, how to train, and how to implement and evaluate training should be informed by the best information science has to offer.”
That is exactly what this paper’s meta-analyses do for training. They use the science of learning to outline how to gain the best outcomes from training. For instance, investments in training must use adequate analyses to ensure that the organization is addressing the right training needs, using the right training methods, and taking the right actions before, during, and after training. Simply stated, like retirement investments, we must analyze, monitor, and follow up on our training investments.

To be sure, the science of learning provides evidence-based training design principles, and training developed with these principles provides better outcomes for our organizations. But design principles are not always enough. Training is a systems issue. If learners don’t feel confident, even good training may not take. If learners return to an environment that doesn’t support the training, even good training will fail. Bottom line: L&D professionals involved in designing training need to understand the entire learning system.

Reference
Wrap-Up

Key Learning Science Concepts and How to Apply Them

I recently had a conversation with a prospective client who was looking for a speaker. “Perhaps I could do a session debunking common learning myths, including learning styles,” I mentioned. We were on Skype, and her tone went from attentive to cold. “We spent weeks discussing how to adapt to learning styles in one of my graduate classes,” she replied.

Since that conversation, I’ve seen numerous mainstream L&D sources discussing the “learning styles myth.” Not because people don’t have preferences for how they like to learn, but because research has clearly shown that self-reported measures of learning aren’t valid (see the References section for more) and self-reports aren’t correlated with how people do learn.

What does this mean, really? Should we design learning experiences and resources however we want? No. It primarily means that we should design so people can more easily learn. Learning science tells us how to accomplish this—not fads.

I discuss several key learning science concepts throughout this book. Let’s recap some of the highlights and focus on what you need to know to adopt them in your day-to-day practice.

So People Can More Easily Learn

In chapter 1, I define the science of learning as “an interdisciplinary field of study that examines how people learn, and how the L&D field can improve learning and instruction.”

I believe that learning professionals interested in the science of learning care deeply about making learning easy, are willing to change practice while learning about learning, and are invested in always learning more. The good news is that while the science of learning is interdisciplinary and often complex, it is quite possible to learn the foundations—and more, if you want.

Because deep learning is the ability to apply what you know in flexible circumstances, it’s critical that we avoid teaching people how to simply recall information. Today’s jobs require more. Employees must pay attention to what they have to know how to do, as well as all the circumstances under which they have to be able to do it. If you’re only following directions or reading from a script, you don’t really understand what you’re doing.

Deep learning goes further. It requires understanding what is really going on, applying knowledge in different circumstances, being able to solve difficult problems, recognizing what resources to use, identifying how to keep learning, and so on. This is how far people need to go to do a job well.

In chapter 7, I delve into another problem we see in training today: developing and delivering too much content. The study of cognitive load contends that people can only process a limited
amount of information at a time. Therefore, when we overload people with too much information, too many visuals, or overly complex multimedia, they don't learn as well or they stop trying.

Another significant problem for L&D is that we build training as if everyone is starting from ground zero. In chapter 8, I discuss how research shows that when we connect learning to prior knowledge, people learn more and retain that knowledge more easily. For adults, all learning is a refinement of prior knowledge (what we already know). Of course, there can be issues with prior knowledge: Some people have inadequate prior knowledge and some have inaccurate prior knowledge. There are specific ways of handling these circumstances.

What does this mean for developers? We should determine what people know, help people recollect what they know, fill in gaps as needed, and fix misunderstandings. For example, in the second set of classes on analyzing delinquent patient accounts, we can assume that people have forgotten some of what they learned in the first set of classes. What can you do to help them recollect what they might have forgotten? (Or what might you do to help them remember in between the two classes?)

What Should We Measure?
If we are going to take the time to build instruction, we are usually looking for evidence that people learned. In chapter 5, I discussed direct and indirect evidence of learning. Direct evidence includes tangible work products like product knowledge and Excel spreadsheets. Indirect evidence includes people’s perceptions and rankings such as supervisors’ ratings or customers’ survey data. An ideal assessment might combine direct and indirect measures. This is called “triangulation” of evidence.

What would you consider direct and indirect evidence of learning for the course on analyzing delinquent patient accounts? Direct evidence might include actual results from stepwise analysis, while indirect evidence could include supervisor perceptions about how well people are doing three weeks after the last part of the course. What we are talking about falls under the realm of assessment.

Too often, we leave out questions about the quality of the actual training. I discuss Robert Brinkerhoff’s Telling Training’s Story: Evaluation Made Simple, Credible, and Effective in chapter 6. Brinkerhoff’s model identifies the most and least successful trainees in order to find the impact from training. It’s a rational approach, and it also puts you in touch with actual trainees after the training.

The Best Outcomes From Training
Chapters 9-11 examine the terrific study by Eduardo Salas and fellow authors, “The Science of Training and Development in Organizations: What Matters in Practice.” The study used meta-analyses to find that when the science of learning is used, training has better outcomes.

For example, the research found that needs analysis is one of the best things that L&D professionals can do before training to ensure positive outcomes. Additionally, their research examines powerful strategies that aid learning during training. Finally, according to the study, good communications with supervisors is one of the best ways to ensure positive outcomes after training.
Moving Forward

The content from this book is sourced from a series of posts I wrote for the Association for Talent Development’s Science of Learning Blog. I write regularly for the blog, so be on the lookout for additional posts at www.td.org/Publications/Blogs/Science-of-Learning-Blog. Additionally, please let me know which key learning science principles you’d like to learn more about. That’s what I’m hoping to concentrate on in the new year.