Aligning the Learning and Performance Contexts
Creating Spontaneous Remembering

Researched and Written by Will Thalheimer, PhD

A Work-Learning Research Document
© Copyright 2002-2009 by Will Thalheimer
All rights are reserved

Value: $295, Available Free*
Number of Pages: 54 (8.5 x 11 inches)
How to cite this report using APA style:


Obviously, you should substitute the date the document was downloaded for the fictitious November 31st date.


The Author: Will Thalheimer is a learning-and-performance consultant and research psychologist specializing in learning, cognition, memory, and performance. Dr. Thalheimer has worked in the workplace learning field, beginning in 1985, as an instructional designer, simulation architect, project manager, business leader, trainer, consultant, and researcher. He has a PhD from Columbia University and an MBA from Drexel University. He founded Work-Learning Research in 1998 to help client organizations create learning environments to maximize performance and help learning professionals—instructional designers, e-learning developers, trainers, performance consultants, talent managers, and chief learning officers—utilize research-based knowledge to build effective learning-and-performance solutions.

Dr. Thalheimer can be contacted at info@work-learning.com or at the Work-Learning Research phone number below for inquiries about learning audits, workshops, speaking engagements, high-level instructional design, and consulting on e-learning, classroom training, learning measurement, learning strategy, and business strategy for learning.

Work-Learning Research, Inc.
Somerville, Massachusetts USA
(617) 666-9637
www.work-learning.com

All information contained in this document is copyrighted. © Copyright 2002-2009 by Will Thalheimer. All rights are reserved.

*Sharing Rules: You may copy and distribute this document as long as you (a) share it intact and whole, (b) don’t charge a price for it, and (c) don’t include it in any priced event or product, (d) don’t share it in a manner that generates good will that might be translated in the future into tangible financial benefits.

I do not receive a salary for translating research into practical recommendations. You can help support my work by (1) following the spirit of the sharing rules; (2) passing this report to others; (3) consider advertising within this document or on my blog/website; and/or (4) hiring me to consult, speak, give workshops, audit or evaluate your learning interventions or audit your work-learning environment. Thanks!!
Acknowledgements

Given that this report is a research-based effort, I must first and foremost acknowledge the researchers whose work this document is based on. The authors of the relevant studies are listed in the References section. Because every researcher builds on the work of numerous others, the authors cited represent only a small fraction of those who should be thanked for their contributions.

Although the responsibility for the research-based ideas in this manuscript can be attributed to the original researchers, the limitations and weaknesses of the current effort must rest firmly on my shoulders.

Special thanks are offered to Allison Stieber, whose copyediting improved the text immeasurably. Thanks also to Samantha Cook for providing expert statistics help.

Will Thalheimer

Updated for 2009

I have added a brief section later in the report updating this report based on recent research findings. In short, the general context-alignment effect described in the 2002 report continues to be supported.
How to Read This Report

The ultimate goal of all Work-Learning Research publications is to help you make research-based instructional-design decisions. We compile research on learning and performance from the world’s best sources. Then we repackage it so that it’s practical and accessible. We give you an in-depth understanding of the human learning system so that you can make informed choices in your instructional designs.

It is our belief that the learning-and-performance field will serve learners better when researchers and practitioners begin to work hand in hand. The first step in this process is for each group to understand the language and issues faced by the other. Our Instructional Research Reports are written to facilitate mutual understanding between these two groups.

By the end of this report on the alignment of learning and performance contexts, you can expect to have a clear picture of how the two contexts can be aligned to help learners retrieve information from memory when they are faced with their on-the-job performance situations. You will also understand more fully how the human learning system works.

Work-Learning Research Instructional Research Reports present concepts that will be new to many readers, using a language and perspective that may be unfamiliar and provocative. The reports are designed to help you gain comfort with this new set of concepts, but some perseverance may be required on your part. Don’t feel that you must memorize every term or understand every concept. Information will be repeated and reinforced throughout the report.

Each major learning point is introduced with a practical question about how instruction should be designed. You will learn more if you carefully answer each question before reading further. Don’t peek at the answers! After you answer a question, we will provide you with information on “Why It Works This Way,” which will describe how the human learning system creates the effect being discussed. You will be asked a series of questions—and given feedback—after which you will be offered a summary of “Practical Recommendations.” Next, we will provide several sections that outline the “Research Background” for the major learning points. Some readers may prefer to skip these research-intensive sections. Others may want to more fully understand how the research supports the practical recommendations. Finally, we offer realistic practice questions to help you retain and refine the knowledge you’ve gained.

The research sections in this report include research citations, typically enclosed in parentheses like the following (Thalheimer, 2002). The parentheses will include the researcher(s) name(s) along with the date of publication. Unless you want to find the original article, you can ignore this information. On the other hand, it’s often fun to look at the date to see when the research was done. The references are included to provide research-based support for the claims in the paper and to give the researchers their due.

Enjoy!
Realistic Questions with Explanations

Three vice presidents at the Rainbow Company need to prepare a presentation to the board of directors. The person who makes the best presentation will be offered the job of President. All presentations will be made in the Blue Boardroom on Monday. Each candidate prepares carefully over the weekend. Who is more likely to become the new president of the Rainbow Company?

A. The person who prepares in the Blue Boardroom.
B. The person who prepares in his or her small office cubicle.
C. The person who prepares at a log cabin in the mountains.
D. The setting of the preparation is unlikely to affect performance.

Correct Answer: Second Letter: DACBDAC

The person who learns his or her presentation in the room where it will be retrieved from memory will perform the best.

Why It Works This Way:

Learning is associative. Whenever we learn something, we associate that learning subconsciously with the background stimuli of that situation. Thus, if we learn about microeconomics in a cold, damp, and dismal blue room, our memory will associate microeconomic notions of supply and demand with that cold, damp, and dismal blue room. If we later enter that blue room, microeconomics notions will be more likely to pop into our heads than if we’d entered a warm, pleasant room.

Remembering information does not occur through some random, spontaneous process, although it may seem that it does. Instead, we tend to remember a particular idea when it is triggered by some associated information that is present in our environment or in our thoughts. For example, in the presence of hay, I have a tendency to think of my grandfather’s barn, where I spent time as a child. When someone uses the word “pediculous”—a word that means infested with lice—I’m reminded of my grandfather’s suggestion that I stop using the word “lousy” in every sentence. When I think of old people having cancer, I think back to the tears my grandfather shed as he was dying. When I think of my grandfather (as I do while I write this), I think of many things.

Our knowledge is interwoven in a complex matrix of associations. When we think of one thing, we’re reminded of another. Often it seems that our thoughts spontaneously pop into our minds, but random causation is unlikely. Researchers have not yet determined the extent to which our thoughts might be randomly generated, but for all practical purposes we can assume that a triggering stimulus instigates every thought we have.
In the question above, the person who prepares in the Blue Boardroom will be more likely to recall the details of her presentation. When she enters the Blue Boardroom on Monday, the stimuli she encounters will trigger ideas she thought about over the weekend while working in that room. Briefly, here’s how the process works for her. When she’s learning, she’s absorbing both the details of her presentation and the background stimuli in the room. The thoughts she has over the weekend become associated with the Blue Boardroom. When she reenters the Blue Boardroom, the background stimuli in the room will remind her of the thoughts from her weekend of preparation. Recalling these thoughts will enable her to enrich her presentation with more insights and anecdotes.

If you don’t think this type of context effect happens to you, think about trying to recall someone’s phone number without the touch-tone keypad. It’s not always easy. Why? Because you learned that number in the context of the phone keypad, and you’ve come to rely on the keypad for contextual clues about what numbers to hit next.

Similarly, you probably have had the experience of walking down the street, seeing a person whom you know, but not being able to remember either her name or where you know her from. It’s not that you’re stupid. Your memory deficit is caused by the fact that the contextual clues you normally use to remember her are missing. It doesn’t matter that she is a member of your congregation, that you’ve spent several evenings studying world religions together, and that you’ve been introduced to her as “Andrea.” Seeing her in the street draws a blank because the street scene doesn’t provide the contextual clues you’re accustomed to using when you recall her name and other relevant information.

One final example. You may find that you occasionally walk from one room into another room and then can’t remember why you entered that room. You may even look around, hoping to see clues that help, but often it’s only when you go back to the original room that the context reminds you of what you were thinking. The original learning context reminds you of what you had thought about. Isn’t it amazing that the human mind is so powerful and yet so simple?

We have to be careful when we think about learning and remembering. Because of our school indoctrination, we tend to think of remembering as an intentional process. Yet most remembering is triggered unintentionally as we move through our everyday lives. When we think about training people to perform in their jobs, we should usually have the goal of creating spontaneous remembering. As we will discover in this section, one key to creating such remembering is to ensure that the environmental cues (and the purely mental cues) in the learner’s environment are linked to the key learning points in the instructional message.
A group of data-entry clerks learns a new software program in a training room where the instructor plays Mozart throughout the class. Which of the data-entry clerks will perform better in using the new software?

A. The clerks who work in a quiet environment with few distractions.
B. The clerks who listen to the rock and roll of the Rolling Stones.
C. The clerks who listen to the classical music of Mozart.
D. Background noise is unlikely to affect the clerks’ performance.

Correct Answer: Fifth Letter: ADBDCAC

The clerks who work with the software under conditions similar to those in which they learned it will perform the best. Background noise matters too.

Why It Works This Way:

As described above, when we learn, we take more into memory than just the intended message. Although the content may contain the message of the instruction, the background context is what the message is written on—and you can’t separate the ink from the paper it is printed on, or the embroidery from the fabric it is woven into. The content and the context are inherently linked, at least in the short term. Because of this linkage, in the question above, Mozart’s music becomes intertwined with the user interface of the new software system. When the clerks return to their cubicles, those who listen to Mozart will be reminded of the procedures learned in the training room.
Several groups of maintenance electricians receive training on a new robotic assembly line. All of the groups learn the functioning of the assembly line. Which group will perform better when they start their work maintaining the machines?

A. The group who learned by using a working facsimile of the assembly line, including a simulation of the electronic circuitry.
B. The group who learned by using a computer-generated simulation of the electronic circuitry of the assembly line.
C. The group who learned by using the traditional schematic drawings of the electronic circuitry of the assembly line.
D. All of the above will produce similar performance results.
E. Both A and B will produce equally superior results.

Correct Answer: Fourth Letter: ECBADEA

The group that learns in the most realistic context will perform the best. The closer the similarity between the learning context and the performance context, the more the cues in the performance context will generate the retrieval of the learned information.

Why It Works This Way:

The working assembly line (choice A) in the above question provides the most realistic context for the electricians. As they learn the electronic circuitry on the working assembly line, the learners are interweaving contextual background information with the knowledge they will be learning about troubleshooting the electronic circuitry. When they begin maintaining the real assembly lines, the functioning of the machine, the smell of the grease, the shape of the robotic arms, and the sound of the conveyor movements, will all remind them of what they’ve learned. The workers who don’t learn with all the relevant cues will have to rely on more fragile memory associations.
Two supervisors at the Rainbow Company need to prepare a presentation to give to their teams to get them motivated to work on a reengineering effort. The team of the supervisor who makes the best presentation will perform better, will be more satisfied with their work, and will receive more lucrative year-end bonuses. Both supervisors recently took a leadership course and are planning to study their notes to help them prepare for the meeting. Both of the presentations will be made in the Blue Operations Room on Monday. Both supervisors want to use the Blue Operations Room over the weekend to prepare, but since they can’t use the room at the same time they agree to flip a coin. The winner will use the Blue Operations Room; the loser will use the Red Operations Room, a nearly identical room next door—except for the color. Each of the candidates prepares carefully over the weekend. Which of the supervisors is more likely to move their team to greater success?

A. The one who prepares in the Blue Operations Room.
B. The one who prepares in the Red Operations Room.
C. Both are likely to perform equally well.

Correct Answer: Fourth Letter: ACBCBAA

Because the rooms are almost identical, any differences in performance due to context effects will be minimal. Having only a few things that differ (in this case the color of the room) is unlikely to produce context effects.

Why It Works This Way:

The supervisor who prepares in the Blue Operations Room will associate the cues of that room with his thoughts on the presentation. During his presentation, the Blue-Room cues will trigger appropriate thoughts and actions. The supervisor who prepares in the almost identical Red Operations Room will associate the cues of that room with her thoughts on her presentation. During her presentation, the Blue-Room cues, because they are almost identical to the Red-Room cues, will trigger appropriate thoughts and actions. If she had learned her presentation in a room that was very different from the Blue Operations Room, the Blue-Room cues would have provided no appropriate memory triggering and may even have been disruptive, causing triggering of the wrong memory stores.
Employees go to an off-site training program where they learn interpersonal communication skills in a happy, rewarding, and almost joyous environment. When they return to their work environment, they face different emotional cultures in their various departments. Which departments are most likely to utilize the new communication skills?

A. The relationship between the mood in the training and the mood in the workplace has very little to do with on-the-job performance of trained skills.
B. Departments that maintain the happy, rewarding, and joyous environment are most likely to use the new skills.
C. Departments that return quickly to their normal work mood are most likely to use the new skills.

Correct Answer: Third Letter: BCBACAB

Mood is context too. The emotional mood in the training room provides a context that becomes intertwined with the content message. When the mood in the performance context is similar to the mood in the training context, it reminds learners of the training context and thus aids retrieval.

Why It Works This Way:

Like all the other context variables we’ve discussed, emotions also act as contextual cues. If a person learns something while depressed, he or she will be more likely to spontaneously remember the learning material when in a depressed state than in a joyous one.

Trainers who think that putting people in unusually pleasant training situations will aid learning are fooling themselves. I have heard of trainers who cover the training tables with linen tablecloths and fresh-cut flowers to make learners more comfortable, in an effort to improve learning. Learners in these programs are advised to bring the flowers back to their linen-covered workstations.
A computer-based tutorial is created to help clerical staff master the new accounting system. The tutorial enables learners to practice using a realistic simulated version of the accounting system. There are 12 forms in the accounting system that must be learned. Which design will produce the WORST performance on the accounting system?

A. Each of the 12 forms in the accounting system uses a gray-blue color scheme. The tutorial has the same gray-blue color scheme for each form.
B. Each of the 12 forms in the accounting system uses a different color scheme. The tutorial uses a gray-blue color scheme for each form.
C. Each of the 12 forms in the accounting system uses a gray-blue color scheme. The tutorial uses different color schemes for each form.

Correct Answer: Fifth Letter: ABBACAC

Learners who learn things in differentiated contexts often become dependent on the contextual cues from those contexts. If those contextual cues are not present when the learners need to perform, their performance will suffer severely.

Why It Works This Way:

Context doesn’t always create positive results. Context can also create poor performance. When a learner learns a concept in a particular situation, the contextual information from that environment will become integrated in memory with that concept. Later, when that concept is needed, if the contextual environment is changed, the person will be less likely to retrieve the concept from memory. This is especially true when the contextual information is directly related to performance. In the example above, if learners learn how to complete (1) a pink invoice form, (2) a yellow expense form, and (3) a blue accounts-payable form using the tutorial, they’ll have a more difficult time performing when all those forms become gray-blue in the real accounting package.

We often experience a similar problem when we learn Jane’s name at church, Joan’s name on the baseball diamond, and Jill’s name at the market. We unconsciously link their names and faces to their respective environmental backgrounds. When we see Joan at the local coffee shop instead of playing baseball at the park, we are much less likely to remember her correct name. We don’t have the baseball cues to help us.
Managers in a high-tech company known for its flat organizational structure and its extensive use of cross-functional teams are trained in leadership skills. The work environment regularly challenges the workers to deal with different situations and different people. Which training design will produce the best leaders?

A. The training that utilizes five different training rooms and five instructors.
B. The training that utilizes one training room and five instructors.
C. The training that utilizes five different training rooms and one instructor.
D. The training that utilizes one training room and one instructor.

Correct Answer: Sixth Letter: CBBACAC

Learners who learn something in many different contexts have multiple cues they can use to aid their memory retrieval and thus are able to perform in a wider variety of situations.

Why It Works This Way:

Context can create dependencies that weaken a person’s ability to recall information outside the context in which it was learned. By prompting our learners to learn information in multiple contexts, we can prevent information from becoming associated only with that context. In this sense, providing multiple contexts enables information to become decontextualized—associated with many contexts and thus retrievable in many contexts. Having multiple contexts also provides multiple retrieval routes through memory, increasing the likelihood that an environmental stimulus or cognitive thought will trigger the retrieval of the information.

In the example above, the best design is one that utilizes five training rooms and five instructors. Instructors are context too. This varied training is likely to be especially important in the company described above because its managers have to perform with many types of people in many different organizational contexts. The more varied the training, the more likely the managers will access the information stored in memory that will enable them to lead.

It’s the same with other types of contexts, not just incidental background contexts. For example, for a person who learns statistics topic by topic, chapter by chapter, learning may become overcontextualized. Suppose learners learn to use the Chi-square statistic during a chapter on how to compare frequency data. They work with examples where they need to apply either the Chi-square test or the McNemar test or the Cochran test. They learn this to great proficiency and do very well on the chapter test covering frequency data. Unfortunately, when it comes to the final exam, problems from all of the chapters are mixed together. Because the learners did not practice outside of the context of their chapter topics, they are doomed to failure. To go back to the example, they learned how to determine whether to use a Chi-square test versus a McNemar test or a Cochran test, but they didn’t learn how
to determine whether to use a Chi-square test versus an analysis of variance versus a t-test.

In many cases, the real world is more like the final exam described above than the chapter test. People have to perform many skills in many contexts. The recommendation of this report to align the learning and performance contexts still holds, however. Our goal as designers of instruction is to determine the boundary conditions of the performance context and align the learning context with those parameters as much as possible. The easiest way to do this is to figure out what we want our learners to do, determine in what situations we want our learners to do those tasks, and then simulate those situations by providing practice during learning. Within those boundaries, we can vary the learning context to provide multiple opportunities for practice. For example, if we know we want our manager trainees to encourage their direct reports to provide input into decision-making, we can simulate several decision-making situations, such as staff meetings, brainstorming sessions, and project reviews. The point of this question is that the more uncertainty we have about the performance context, the more we need to vary the learning context.
Three associates at the Rainbow Company need to prepare a presentation to the board of directors. The person who makes the best presentation will be offered a year-long sabbatical to study the impact of the Internet on the Caribbean beach economy. All presentations will be made in the Blue Boardroom on Monday. Each candidate prepares carefully over the weekend. Who is more likely to spend a year lying on the beach sipping delicious exotic beverages?

A. The person who prepares in the Blue Boardroom.
B. The person who prepares at a log cabin in the mountains.
C. The person who prepares in the Blue Boardroom, and thinks about the Caribbean beach environment immediately before giving the presentation.
D. The person who prepares in the mountain cabin, and thinks about the mountain cabin immediately before giving the presentation.
E. Both A and D will produce similar performance during the presentation.

Correct Answer: Sixth Letter: EACBDEC

By imagining the learning environment, people can facilitate recall of information learned in that environment.

Why It Works This Way:

When people are in an environment in which they learned something, the environmental stimuli trigger their memories and thus aid recall of the information that has become associated with the environment. When people imagine an environment without being in that environment, their memories for that environment can still trigger the appropriate memory pathways to aid retrieval of the learned information.

A computer-based tutorial is created to help clerical staff master a new accounting system. The tutorial enables learners to practice using a realistic simulated version of the accounting system. There are 12 forms in the accounting system that must be learned. Each form is designated by a different color. For example, there is a pink invoice form, a yellow expense form, a blue accounts-payable form, and so forth. Which training design will produce the best performance on the accounting system?

A. The design that encourages learners to use the color context to help them learn the various forms.
B. The design that doesn’t mention the different colors.
C. Both A and B designs will produce equal on-the-job performance results.

Correct Answer: Sixth Letter: BACBCAC
By paying attention to the contextual cues during learning, learners can more fully associate the learned information with those contextual cues. Later in the on-the-job situation, the contextual cues will aid the retrieval of the learned information.

**Why It Works This Way:**

Imagine that a group of learners enters a room blindfolded, learns some information, and comes back the next day to the same room without the blindfolds to take a test on the information they learned in that room. Although some of the context of that room may be helpful in eliciting the learned information (for example, the smell of the room), the visual stimuli will not be associated with the learned information and will not help facilitate retrieval of that information. Although obvious, this example points to the importance of how fully the contextual information is processed. The more that learners process the contextual information during the learning situation, the more that information will be stored in memory and the more it will help aid retrieval when the original learning context is encountered again. On the other hand, if we want to avoid contextual handcuffing, we would probably want to design the learning situation to de-emphasize the contextual environment.
A group of computer operators take a course on the topic of computer security in the company’s luxurious executive training room. They are all preparing to take a national credentialing exam in one month. The exam consists of 100 multiple-choice questions and will be given in the executive training room. Which person is likely to do better on the exam?

A. The person who studies the course materials in the executive training room.
B. The person who studies the course materials in his own office.
C. Both will do equally well.

Correct Answer: Fifth Letter: ACABCAB

Contextual cues produce retrieval effects only when more powerful cues are not available. In the question above, the multiple-choice alternatives in the test provide more powerful cues than the contextual background stimuli in the executive training room.

Why It Works This Way:

Although this report highlights the power of contextual information to affect memory retrieval and performance, it must be noted that background information may not be as powerful as other cues in promoting memory retrieval. For example, an accountant who knows that invoices must communicate a payment due date will use this overlearned retrieval route to remember to include the due date rather than relying on the fact that the pink form must include the payment due date. In this case, the pink cue is not as powerful as the invoice cue because the memory retrieval route from “pink” to “payment due” is not as strong as from the cue “invoice” to “payment due.”

The human mind tends to use whatever cues it can to help improve memory retrieval. Usually those cues are going to be connected in memory to well-learned connections. I remember my father’s name because I’ve known it all my life. I recall the directions to Silly’s Restaurant because I’ve driven there many times. The cue “Let’s go to Silly’s” triggers the overlearned retrieval route, and my mind instantly recalls the way to the Portland eatery. However, when we learn new information or when we have very little experience with something, our minds often must rely on much less certain retrieval routes. In these cases—and these are typical of training and learning situations—the mind grabs onto any cues that help.

Multiple-choice tests provide a set of cues for the learner to use in attempting to retrieve the right answer. Each alternative answer is a cue that triggers retrieval routes that search memory for enough understanding to answer the question. For example, for the question, “What is the capital of Maine?” (a. Montpelier, b. Portland, c. Augusta), the cue “Montpelier” might find the retrieval route that notes that Montpelier is a town in Vermont, the cue “Portland” might prompt the test-
taker to recall that Portland is the biggest city in Maine, and the cue “Augusta” might find that Augusta has a familiar ring to it as the capital of the state of Maine.

Because multiple-choice cues are so strong and viable, the mind doesn’t need to rely on other, more incidental cues. In this type of case, contextual cues are not needed because they are relatively weak compared with the strong cues of the multiple-choice questions. Thus, in the question above, both learners will do equally well because the background context provided by the executive training room will be relatively ineffective as a cue compared to the cues provided by the multiple-choice credentialing exam.

The mind, as can be seen in this discussion, is a giant pattern-grabber. It peers out into the world and looks to make sense of what it sees. It looks for cause-and-effect relationships. It looks for correlations—“when this happen, this often seems to happen.” It tries to find meaning and color in a gray and befuddled cacophony. This is, of course, the brilliance and power of the mind. It is also its greatest weakness. Sometimes it makes the right sense of what it observes, but sometimes—quite often, really—it makes the wrong sense of what’s going on. The human mind has unraveled the mystery of DNA, but it has also determined that swamp gas causes malaria, demons cause mental illness, and going outdoors causes colds.

I’ve often thought that the world would be a better place if we could educate people that astrological signs, New Age energy work, and faith-healing are practices that, although they seem to produce effects, rely on the mind’s penchant to create meaning even when presented with random patterns of stimuli. However, I’ve begun to entertain the notion that this tendency is inherently human—and a characteristic not to be eradicated but to be honored with wary amusement. We don’t want to lie to ourselves, but if we get rid of our zeal for making meaning we might also lose the mechanism that propels our enthusiasm for art, creativity, spirituality, and other aspects central to the human experience.
Practical Recommendations

It is best to train people in the same environmental and emotional context in which they will have to perform. This can be accomplished through several means:

1. Design the learning context so that it is similar to the performance context.
2. Change the performance context so that it contains some of the contextual elements of the learning situation.
3. Add cues to the learning context that can be transported to the performance context.
4. Provide multiple learning contexts—decontextualize the learning—so that the information learned is retrievable in a wide range of situations.
5. Prompt learners to imagine the learning context while they are in the performance context, and vice versa.

These five points will be discussed in turn. The first method is probably the most powerful and is often the easiest to implement. Fortunately, there are many ways that we can design the learning context to be more like the performance context. For example, classroom training can be made more context-relevant by using realistic examples, case studies, role-plays, simulations, and job-related equipment; by working on the learner’s current issues; and/or by inviting learners’ fellow workers to attend the class. Moreover, the mood, noise, smell, etc., can be made to be more like those found in the real-world work environment. Similar opportunities are available for e-learning and multimedia as well. Both can create simulations of on-the-job decision making, utilize video that includes aspects of the performance situation, and prompt learners to answer realistic practice questions. E-learning can also promote a bond between people who work together through intranet threads, synchronous discussions, and agenda-sharing activities. Because this first point is so important, we will explore it in greater detail after we review the other four options.

Although it is often difficult for us as instructional designers to modify the performance context, creating such changes may enable us to improve learning outcomes significantly. A learner’s manager can be asked to reinstate the context by using the language introduced in the instruction, discussing the conceptual models presented in the classroom or online, and tying acknowledgements and rewards to the performance of the learned information. Performance-support systems and take-away tools can be designed to provide learners with hints about what to do when they’re on the job. Learners can be sent emails requiring them to answer realistic simulation-like questions related to what they’ve learned. All of these mechanisms provide learners with reminders of what they learned in the initial instruction.

---

1 Because humans are social animals, and because other people are critical to our success and happiness, the people that surround us are often our most important contextual stimuli. Having our coworkers in class makes them cues for us, facilitating our memory retrieval back on the job.
If neither of the methods above is practical or sufficient, it may be useful to give learners cues to use during learning that they can also use while they are performing. Learners may benefit from listening to a piece of music during learning if they are willing and able to listen to that same piece during their performance situation. Thus, although some parts of the learning context may not be portable, stimuli that can be transported between learning and performance situations can provide contextual cues that aid retrieval. Background stimuli other than music can also be effective. Conceptual models of the main learning points can be useful if learners can find a way to display or access them in their on-the-job situations. Performance-support tools that were introduced during the learning can also be used in this manner.

"But seriously, one of the things that brings me the most pleasure is to help others see things they hadn't seen before. To utilize information they've learned from my research efforts, to transform their learning environment to one that really works."

Dr. Wil Thalheimer  info@work-learning.com

When the performance situation cannot be predefined, it is best to provide multiple contexts for learning. When a learner’s work environment is constantly changing or varies considerably during the course of the workday—or when the work situation can’t be clearly delineated in advance—providing the learning in multiple and varied contexts will aid on-the-job retrieval. If multiple contexts cannot be supplied (and if learning and performance contexts cannot be aligned), the learning environment should be made as non-distinctive as possible so that learners don’t become tied to the distinctive cues of its surroundings. Multiple contexts can be supplied in many ways, such as using different background stimuli, offering the learning in several rooms, utilizing multiple media-delivery options (blended learning), and having different instructors. Learning can be spaced over time, which tends to provide varied mental contexts for learners. The most powerful option may be to provide different examples, practice opportunities, or simulation scenarios. If we’re teaching our learners to cut and paste, we could have them do it within a word-processing program, a spreadsheet, and a database. If we’re teaching accountants the time value of money, we could ask them to practice explaining the concept to investors, small-business people, and MBA students.
Encouraging learners to think about their learning environment when they are in their on-the-job performance environment can augment the above methods or be used in lieu of them. When a basketball coach in a timeout tells his players to run a set play, he is essentially telling them to remember how it worked in practice. As designers of instruction, we may have little access to learners in their performance situations, so we may have to be creative to utilize this principle. We can tell learners during training to remember to think back to the learning situation when they enter their work situations, but we’ll likely have to do more than this to gain the advantage of context. By providing learners with performance-support tools, take-aways, email reminders, follow-up questions, and management intervention, we are essentially prompting them to think about the learning situation. We can go further by providing coaching options, especially through action learning, online sessions with the original instructors and learners, and collaboration between learners who took part in the same instructional experience. Of course, if we’re fortunate enough to be available for our learners when they are utilizing what they learned on the job, we can tell them to think about the environment, the events, the mood, and the topics that were discussed during the learning situation.

These five methods alone can have powerful effects, but they can be augmented as well. First, we can strengthen the memory linkage between the learning points and the background contextual cues by having learners reflect on the circumstances in which they will use each piece of information they are learning, for example by asking them, “Where will you run your management meetings?” and “Who will be there?” and “Under what circumstances will you offer praise to individuals versus giving praise to the whole team?” This type of reflection helps each learner link what is being learned with his or her performance environment. When the learners reenter their work environments, they’ll be more likely to activate the memory stores of the learning points they worked on during learning. Because they’ve thought of what they are going to say to “Stan” about being more of a team player, they link in memory their image of Stan and the gist of the verbalization they have learned to make. When they return to the workplace and see Stan, he’ll act as a cue to remind them about what they wanted to say to him.

Context effects can also be enhanced by ensuring that each contextual cue has as few learning points associated with it as possible. Think of it this way. If a person takes courses on history, biology, poetry, and current events in the Blue Room, thousands of learning points will be associated with the Blue Room, and returning to the Blue Room will produce a diminished context effect. Alternatively, if a person learns about Abraham Lincoln in the Red Room, Teddy Roosevelt in the Green Room, and George Washington in the Blue Room, maybe 10 learning points will be associated with the Blue Room, and returning to the Blue Room later is likely to provide some very useful cues.

Of course, this type of contextual differentiation is likely to be impractical on a large scale, especially when manipulating environmental background context. The key is not to provide one learning room for each president of the United States.
Instead, we should (1) reduce the number of learning points per contextual stimulus to a reasonable extent, (2) try to provide cues in the learning environment that mimic those in the performance environment by providing realistic practice opportunities.

Although we cannot always accomplish this perfectly, we can strive to reduce the number of learning points per contextual stimulus. We can do this in either of two ways—by decreasing the number of learning points or by increasing the contextual cues. To decrease the number of learning points, we can prompt our manager trainees to remember to do five things when they are running a meeting, not twenty. We can provide learners with general themes so that they can organize many details into a few major categories. To increase the number of contextual cues, we can create a different color for each function in the accounting software and then mimic the software cues in the training course. We can add stimuli from the performance situation to the training room by bringing in the charts, posters, or slogans that are familiar at the work site. Note that one shouldn’t just increase the number of cues during learning unless these cues will be observed in the performance situation.

Second, we can provide cues in the learning environment that mimic the performance environment as much as possible. By doing this, we don’t have to work impossibly hard to relate each cue to one, or even a few, learning points. By simply aiming for realism, we’re taking a shortcut to creating richer contextual elements. Realism, by its very nature, adds context. For example, if we prompt managers to practice running a meeting in a training seminar, running-a-meeting cues will become associated with words and phrases managers must speak to successfully lead their teams. Similarly, if we have computer operators use realistic software interfaces to practice their skills, the rich and varied cues of the software will become linked to the correct actions that they are learning.

All of the above ideas rely on the observation that information learned in one context is more easily retrieved from memory if the cues from that context are observed during the performance situation. When cues in both the learning and performance environments can be made to match, context can have powerful positive effects. When cues cannot be made to match, context can have powerful negative effects. To enhance the positive effects that accrue when cues match, instructional designers and instructors can prompt learners to pay attention to context during both learning and performance. To limit the negative effects that occur when cues don’t match, instructional designers and instructors can focus attention away from context during learning and performance.

To end this section, let’s return to our discussion of how to construct the learning context to align it with the performance context. To better understand how to do this, we need to first understand a little about the human cognitive system and how it works to create performance.
People in their performance situations are reactive beings. They react to environmental stimuli. In some sense, the stimuli in our environment control our thoughts. Not completely, but almost. If I tell you to say the first thing that comes to mind when I say “hot,” you’re likely to say “cold.” When I say “up,” you’re likely to say “down.” My words influence your thoughts. When a salesperson who is cold-calling to set up appointments hears, “We don’t have a budget for that” from a local prospect, she ought to be able to react with fluency and say, “That’s okay, why don’t we meet anyway?” When a medical technician spots a safety hazard, he ought to react by immediately remedying the situation.

Let’s examine how this happens in greater detail. Learners in their performance situations are (1) confronted with environmental stimuli and (2) must evaluate the stimuli (in other words, make sense of them), (3) decide what action to take, and (4) take the action. This process can be diagrammed as follows:

Situation → Evaluation → Decision → Action

Sometimes this process is conscious and intentional. Other times it is an automatic, almost unconscious process.

To create a learning context that aligns with the performance context, it is critical to have learners experience each of the four stages presented above. We should create a learning situation in which the cognitive processing involved at each stage mirrors the cognitive processing that will be required of learners in their performance situations. The learning situation should resemble the performance situation or provide a clear analog. In some ways, this is the most obvious and the easiest step of the process.

Learners should also be prompted to evaluate the situation in the same way that they will evaluate the performance context. Put simply, learners should be asked to make sense of a realistic environment before they are asked to make a decision about what to do. So instead of telling learners in a hazardous-materials course to make a decision about which safety procedure to use, learners should be given situations and asked to determine whether there is a safety issue in the first place and, if so, to classify the type of safety issue at hand. As instructional designers, if we skip the “Evaluation” stage, we don’t prepare our learners for their real-world environments. We don’t give them practice in determining what’s happening—a skill they will need on the job. Case studies, simulations, and hands-on practice can be particularly effective in presenting realistic situations and asking learners to evaluate a complex environment.

Learners must also practice making decisions about which actions to take. The more the practice decisions mirror the decisions learners will have to make in their on-the-job situations, the greater the learning and the better the performance. Although multiple-choice questions can be made fairly realistic in the sense of creating an authentic situation to assess, asking learners to choose between alternatives limits the realism because in most real-world situations we are not given a list of actions...
we can take. Instead, we have to make up our own set of decision options. Although tradeoffs must often be made between aiming for realism and creating learning that won’t tax the mental energy of the learner too much, in general learning will benefit when realism is the goal. If designed optimally, simulations, case studies, questions, and role-plays can provide practice in decision-making. Similarly, realistic practice of movement skills can be created to propel context effects.

Finally, learners should be prompted, as much as possible, to practice the actions they will have to take on the job. When the actions are trivial or are already well practiced by the learners, this may not be necessary. For example, if we’re teaching someone to push a button to advance printer paper, we can probably focus on the decision-making that is required to diagnose printer problems—we do not have to provide button-pushing practice. It’s interesting that in many courses of instruction we forgo practicing the actions. In most management-training courses we tell managers, for example, to include their direct reports in decision-making, and we may even provide them with simulations that ask them to make decisions about when and where to do this. We rarely give them practice in how to introduce this type of initiative to their direct reports. In some sense, then, we’re providing our learners with the knowledge of what to do, but we’re not providing them with practice in how to do it.
Research Background

Research psychologists have found that learners will retrieve more information from memory if they try to retrieve that information in the same room in which their learning took place (e.g., Smith, Glenborg, & Bjork, 1978). Similarly, when scuba divers learn underwater, they recall more underwater than nearby on land, and vice versa (e.g., Godden & Baddeley, 1975). When people learn during a time when they are sad, they’ll remember more when they’re sad, and vice versa (e.g., Bower, Monteiro, & Gilligan, 1978; Eich, 1995; Smith, 1995). When people learn under the influence of alcohol or marijuana, they recall more when tested under the influence, and vice versa (e.g., see studies reviewed by Eich, 1980). When people learn while smelling peppermint, they retrieve more information when smelling peppermint than when smelling osmanthus, and vice versa (Herz, 1997); they remember more when smelling chocolate when they learned while smelling chocolate (Schab, 1990); and they remember more about a long-ago museum visit when they are reintroduced to the museum’s unique smell (Aggleton & Waskett, 1999). When college students learn with loud noise as a background, they do better on tests when those tests are accompanied by loud noise; silent studying improves performance during silent test-taking as well (Grant, Bredahl, Clay, Ferrie, Groves, McDorman, & Dark, 1998). If people have learned while listening to Mozart, they retrieve more of the learned information while listening to Mozart than they do while listening to jazz (Smith, 1985). Bilinguals interviewed in Russian remembered more “Russian” memories than English memories, and when interviewed in English remembered more “English” memories (Marian & Neisser, 2000). These varied results show that context—whether it is environmental, emotional, or physiological—can provide cues that aid future retrieval of learned information. In other words, returning to the same context facilitates retrieval of information learned in that context (for reviews see Bjork & Richardson-Klavehn, 1989; Smith, 1988; Smith & Vela, 2001; Eich, 1980; Roediger & Guynn, 1996; Davies, 1986).

Although context effects have been found using many types of context, and these effects have been strongly corroborated in animal research (for reviews see Balsam, 1985; Riccio, Richardson, & Ebner, 1984; Spear, 1978; Bouton, 1993), many studies have failed to find context effects. Fernandez and Glenberg (1985) tried to duplicate exactly a published study and still could not produce the context effects found in the earlier work.
How can it be that context effects are found sometimes but not others? Should we conclude that context effects are too tenuous to consider utilizing in practice? To answer that question, we need to explore context effects more fully by diving into the research more deeply. Context effects are more robust when recall rather than recognition tests are used. Godden and Baddeley found context effects for scuba divers using recall tests (1975) but not scuba divers using recognition tests (1980). Experiments on recognition tests have more often than not failed to produce context effects (e.g., Smith, Glenberg, & Bjork, 1978; Eich, 1985; Jacoby, 1983). Context effects tend to be stronger using less familiar learning materials (Dalton, 1993; Russo, Ward, Guerts, Scheres, 1999; Vela, 1984, as cited in Wright & Shea, 1991) and more difficult tasks (Wright & Shea, 1991). Context effects are more likely when contextual cues are more salient (Eich, 1980; Herz, 1997). People who are trying to retrieve information in a context different than their learning context are more apt to cluster their answers into categories than are those who retrieve information in their learning context (Cousins & Hanley, 1996).

Taken together, these experimental results point to an essential truth about context effects. Contextual cues are useful in retrieval to the extent that other cues are not available through perception or working memory. Contextual cues, because they are usually processed as background information, are inherently indirect and comparatively weak. The best metaphor for understanding the relative power of context effects was put forward by Smith (1988, p. 19), though others (especially Eich, 1980) first pointed out the power of non-contextual retrieval cues in limiting context effects. Smith used the word “outshining,” referring to the full moon’s ability to mask the light of some stars and the sun’s ability to completely outshine the light from the stars, to illustrate how other cues could outshine contextual cues. This doesn’t mean that contextual cues are not useful. Context effects can improve retrieval performance significantly, depending on circumstances. What the outshining metaphor suggests is that context effects don’t produce an impact in all situations. Thus, it is important to clarify that sometimes the light from contextual cues outshines the light from other cues and sometimes—as when stars shine
through the light of the full moon—contextual cues may have an impact even when other cues are operative.

I am now going to return to the empirical results described two paragraphs above and show how the comparative strength of contextual cues relates to those results. In recognition tests, the multiple-choice answers outshine contextual cues (Smith, 1988). When learning materials are familiar, contextual cues are not as useful because the information is already well integrated in memory and other retrieval routes are available for use, so the retrieval routes produced by the contextual cues produce relatively little advantage. When contextual cues are less salient—for example, when a common scent is less distinctive than an exotic scent (Herz, 1997)—the contextual cue is like a dim star, easily outshone by other cues. Finally, the fact that people who had access to contextual cues used them instead of using cues from the similarly categorized information shows how contextual cues can outshine other cues.

Remarkably, background context is sometimes almost as powerful as a cue as the material that is being learned. Weiss and Margolis (1954) used a paired-associate methodology where the first part of the paired associate was a pair of nonsense syllables (for example, “mot-fud”) and the second part was a four-letter word (for example, “ring”). Each paired associate was placed on different-color cards (a different color for every pair). Experimental subjects learned these pairs by being presented with the left side of the card while the right side was hidden. Thus, they were shown the first part of the pair (mot-fud) and they had to try and guess or remember the second part of the pair (ring). After they responded, they were shown the right side of the card. The subjects continued until they could correctly remember all of the pairs in the list. A day later, they had to repeat the procedure, recalling the word on the right side of the card when they were shown the left side. During this test, those who saw the first part of the pairs on the same colored cards on which they had been learned recalled an average of 7.37 out of 9 possible words. Those who saw the first part of the pairs on gray cards recalled only 3.25 words. Those who saw only the colored card—without the “mot-fud” stimulus—recalled an amazing 5.37 words, 73% of the amount recalled by those who saw the “mot-fud” stimulus on the same colored card. These folks saw completely blank cards and still were able to recall 73% of the words on the hidden side of the card! In this case, the background context alone was enough to produce fairly good performance.

Wright and Shea (1991) found a similar result, though they used typing as the experimental task, not recall of paired associates. In their experiment, subjects were required to type a four-letter sequence when the numbers 1, 2, 3, and 4 were presented on a computer screen over a keyboard diagram. That is, when a 1 appeared above the “J” key, a 2 over the “D” key, etc., they pressed the “J” key first, the “D” key second, etc. After several learning trials their accuracy approached 80%. When they were later tested with the same background displays, subjects who were presented with no numbers to prompt them got 25% correct—a
performance better than they had accomplished during their first learning trial when they had the numbers to guide them.

It should be mentioned that Weiss and Margolis’s (1954) experiment had two characteristics that strengthened the power of the contextual background to aid retrieval. First, each background cue had only one learning point associated with it (one color per each paired associate). This enables learners to more clearly associate the learning material with the contextual background. This is very different from learning information in a particular room where there is not a one-to-one correspondence between cues and information learned. The second advantage accruing in Weiss and Margolis’s (1954) study is that the first part of the paired associate comprised two nonsense syllables, making at least part of the learning material somewhat unfamiliar—a characteristic that, as already noted, increases the power of contextual cues to aid retrieval. Despite these two advantages, the experiment provides a good example of the potential power of background context in terms of both advantages and disadvantages. The colored background helped when it stayed the same, but it actually hurt when it was unavailable during retrieval; decreasing performance from 7.37 words for the same-colored cards to 3.25 words for the gray cards, a decline of 56%.

The study by Weiss and Margolis shines a spotlight on a very important point, which to my knowledge has yet to be discussed in the research literature. Put simply, context effects may result from either the benefits that result when context is reinstated at retrieval or the harm done by not having context reinstated at retrieval. To clarify this idea, it helps to understand the experimental methodology. Research on context effects has compared people who have both their learning and their retrieval in the same context (“same context”) with those who have their learning in one context and their retrieval in another context (“different context”). When “same context” is compared to “different context,” “same context” usually outperforms “different context.” This finding can result because (1) reinstating the context helps the same-context condition, (2) not reinstating the context hurts the different-context condition, or (3) both. Research hasn’t explicitly teased apart the positive versus the negative effects of context (and it may not be able to), so we need to be open to both possibilities2. Regardless of which of these cause-and-effect relationships is operative, it is better to have the performance situation (where retrieval is required) be similar to the learning situation, a principle that has been immortalized in the “encoding-specificity” principle (Tulving & Thompson, 1973) and in the notion of “transfer-appropriate processing” (Bransford, Franks, Morris, & Stein, 1979).

---

2It is easier to show that context has a negative effect when it is unavailable during retrieval (e.g., Weiss and Margolis, 1954; Dulsky, 1935). Very few experiments have documented that context has a beneficial effect (as opposed to just being better than a different-context condition). Parker and Gellatly’s (1997) research is suggestive in showing the advantages of context, demonstrating that adding music or odor to both learning and retrieval aid memory when testing moves to a different room.
We have already talked about how background cues at retrieval facilitate remembering because they were previously linked in memory with the learned information. Usually such linking is done unconsciously and without an intention to link the cue and the information to be learned. However, when cues and information are purposely linked, memory retrieval may be facilitated even more—for example, when learners trying to remember the word “kite” are encouraged to imagine a kite sitting on a desk that they can see in the learning room (Eich, 1985). Although this strategy may depend somewhat on how easy it is for a person to create an image of the material to be learned, most reviewers agree that the more the context and learning material are cognitively integrated, the more likely the cue will trigger memory retrieval during the performance situation (Smith, 1988; Bjork & Richardson-Klavehn, 1989; Roediger & Guynn, 1996).

Sometimes it is impossible to create similar contexts for both learning and performance situations—often we don’t have control over one or both. When we have control over the learning context and we know the performance context, we can modify the learning context to make it more similar to the performance context. When we have control over the learning context but don’t know or can’t anticipate the performance context, we can provide multiple contexts so learners can decontextualize their learning. When we don’t have enough control over the learning context, we can encourage learners to mentally reinstate the learning context; in other words, we can get learners to think about the context before and during the performance situation.

Fortunately, we don’t have to be slaves to our contexts. If we can remember the context we learned something in—if we actively think about it while we’re trying to perform—we can recall as much of what we learned as if we were actually in the context we learned it in (Smith, 1979; 1984). Smith (1979) found that learners who thought of the learning context while trying to recall lists of words retrieved just as many words as learners who were actually recalling words in their original learning contexts. There is some weak evidence from Smith (1979, Experiment 3) that when the original learning context is made more difficult to recall, imagining the original learning context has no appreciable effect. I cite this finding despite the relative weakness in the evidence because it points to the very plausible possibility that the value of imagining the learning context will be lessened when the learning context is difficult to recall. Such difficulty may result from the confusion of learning.

---

3 The evidence is weak because the manipulation used didn’t really work. The experiment had people learn lists of words in one room (the list-learning room) and then learn four different types of information (different from list-learning) in either one other room or four other rooms. It was assumed that people who learned the other stuff in four other rooms might not be able to remember the cues of the list-learning room as well as did people who learned the other stuff in one other room. It was hypothesized that this inability to remember the cues might cause poorer retrieval of the list-learned words. While the list-learned words were less remembered when the other stuff was learned in four other rooms, the number of cues that people were able to recall did not differ between the groups that learned the other stuff in one room versus four. The caveat on this caveat is that previous recall of the words from the list-learning room may have equalized the ability of the two groups to recall the contextual cues.
different material in multiple learning contexts (as in Smith, 1979, as just mentioned) or from a lack of salience of cues in the learning context.

Often we can’t clearly define the work context. For example, a manager may have to utilize leadership skills in a tense meeting room, during a relaxed lunch, while the boss’s radio plays the Grateful Dead, in a one-to-one conversation with a perfumed employee, etc. When the work-performance context cannot be clearly defined, it is best to provide learners with multiple and varied learning contexts. Smith, Glenberg, and Bjork (1978) showed that presenting learners with a list of words to memorize in two different rooms improved memory performance by 53% over learning the words in the same-room context twice (a whopping effect-size improvement of 3.80). Smith (1982) found a similar effect in Experiment 1, showing 32% better performance when people learned a list of words in four rooms rather than in just one. In Experiment 3, Smith (1982) found that people who learned in three rooms outperformed people who learned in just one room by 24%, though the difference did not reach statistical significance. Gartman and Johnson (1972) found a similar effect using semantic contexts instead of room contexts.

Finally, a recent study by Parker and Gellatly (1997) showed that when adjunct contextual cues are introduced to an environmental context at learning and then provided in a different environmental context during retrieval, these adjunct cues can facilitate retrieval. Specifically, they found that introducing music and/or odors in one room during learning and then reintroducing them in a second room during retrieval prevented the forgetting typical of room changes. Parker and Gellatly promoted the practicality of their method by referring to these adjunct contextual cues (music and odor) as “moveable cues,” a terminology that highlights the fact that, unlike place-contextual cues, music and odor are potentially transportable from a learning environment to a different performance environment.
Strength of Research Findings:

Does Background Context Enable Retrieval?

Moderate.
Although context-dependent memory has been found in many situations, with many different types of background contexts, it has not been found consistently. Even exact experimental replications have failed, highlighting the fact that research has provided only a sketch of what situations enable context-dependent memory and what situations render it ineffective. Still, as revealed in a meta-analysis of many research studies, context-dependent memory effects are found more often than not (Smith & Vela, 2001). Such context effects are enhanced when there are fewer contextual cues per learning point, there are specific connections between aspects of the learning material and aspects of the context, the material is new to the learner or difficult, the performance situation requires recall of information as opposed to recognition of information, the learning context is unique, and many types of context are combined to improve the likelihood that any one type will be utilized, including contexts from all of our senses (sight, sound, smell, mood, and touch).

Do Multiple Learning Contexts Enable Retrieval in Non-Learning Contexts?

Moderate.
Multiple contexts are more often than not capable of facilitating subsequent retrieval in situations in which learners did not learn. Not all of the experimental results are consistent in this regard.

Does Thinking of the Learning Context Enable Retrieval?

Moderate.
When learners are encouraged to imagine their learning context, subsequent retrieval is facilitated more often than not. Not all of the experimental results are consistent in this regard.
Percentage Improvements:

Does Background Context Enable Retrieval?

When There Is a General Relationship between Learned Information and Context.
(This applies when learning material is learned in a particular context but when there are no specifiable links between aspects of the learning material and aspects of the context.)

Representative Range (same-context advantage over different-context) 5% to 40%.
Percentage improvements have been found of 28, and 41% when people recall information in the same room in which they learned the information instead of recalling information in a different room (Smith, Glenberg, & Bjork, 1978); 30 and 50% for same place over different place (Smith, 1979); 47% for same context (on land or under water) over different context (Godden & Baddeley, 1975); 29% for a short-answer test and 13% for a multiple-choice test for same context (noisy or silent) over different context (Grant, Bredahl, Clay, Ferrie, Groves, McDorman, & Dark, 1998); 33% for same context (odor/music at both learning and performance) over different context (odor/music only at learning) (Parker & Gellatly, 1997); 105% and 53% for same language context over different context (Marian & Neisser, 2000); and 27 and 22% for same place and mood contexts over different ones (Eich, 1995). Although these results may suggest reliable improvements, many experiments not listed have failed to find context effects. Therefore, the representative numbers presented above have been lowered accordingly.

When There Is a Specifiable Relationship between Learned Information and Context.
This applies when there is a relatively close correspondence between aspects of the context and aspects of the information learned.

Representative Range (same-context advantage over different-context) 20% to 90%.
Percentage improvements have been found of 10 and 132% for same over different semantic contexts (Pan, 1926); 39, 111, and 24% for same color context (at both learning and performance) over different color context (color at learning and gray at performance) (Dulsky, 1935); 127% for same context (color of card) over different context (color at learning and gray at performance) (Weiss & Margolis, 1954); and 81% for same context (computer-screen background shapes/colors) over different context (Wright & Shea, 1991).

Do Multiple Learning Contexts Enable Retrieval in Non-learning Contexts?

Representative Range 5% to 35%
Percentage improvements have been found of 53% for learners who learned in two rooms compared with those who learned in the same room when they were tested in a room they’d never been in before (Smith, Glenberg, & Bjork, 1978, Experiment 1); 10% for learning in two rooms over learning in one room, and 32% for learning in four rooms over learning in one room (Smith, 1982, Experiment 1); 24% for learning in three rooms compared with learning in one room (Smith, 1982,
Aligning Contexts

Experiment 3); and 10% for learning in four rooms compared with learning in one room (Smith & Rothkopf, 1984). The last two percentage improvements reported did not reach statistical significance. The estimate for the representative range was lowered to reflect the fact that only a few studies were available and some of them didn’t reach statistical significance.

Does Thinking of the Learning Context Enable Retrieval?

**Representative Range undetermined.**
Percentage improvements have been found of 43% when learners were encouraged to think about the room they learned in compared with receiving no such instructions (Smith, 1979, Experiment 2) and of 47% when learners received instructions to remember their learning room over no instructions (Smith, 1984). There were too few studies to create a representative range.

**Effect-Size Improvements:**

**Does Background Context Enable Retrieval?**

*When There Is a General Relationship between Learned Information and Context.* (This applies when learning material is learned in a particular context but when there are no specifiable links between aspects of the learning material and aspects of the context.)

**Representative Range (same-context advantage over different-context) .50 to 1.20.**
Very large effect-size improvements have been found of 2.25 and 1.41 when people recall information in the same room in which they learned the information instead of recalling information in a different room (Smith, Glenberg, & Bjork, 1978); .95 and 1.11 for same place over different place (Smith, 1979); 1.04 for same context (on land or under water) over different context (Godden & Baddeley, 1975); .94 for a short-answer test and 1.02 for a multiple-choice test for same context (noisy or silent) over different context (Grant, Bredahl, Clay, Ferrie, Groves, McDorman, & Dark, 1998); .62 for same context (odor/music at both learning and performance) over different context (odor/music only at learning) (Parker & Gellatly, 1997); 1.65 and 1.30 for same language context over different language context (Marian & Neisser, 2000); .98 and 1.00 for same place and mood contexts over different ones (Eich, 1995). Although these results may suggest reliable improvements, many experiments not listed have failed to find context effects. Therefore, the representative numbers presented above have been lowered accordingly.
When There Is a Specifiable Relationship between Learned Information and Context. This applies when there is a relatively close correspondence between aspects of the context and aspects of the information learned.

**Representative Range undetermined, but probably large.** Effect-size improvements of .90 and 3.24 have been found for same over different semantic contexts (Pan, 1926) and 2.26 was found for same context (color of card) over different context (color at learning and gray at performance) (Weiss & Margolis, 1954).

Do Multiple Learning Contexts Enable Retrieval in Non-learning Contexts?

**Representative Range, Cohen’s d effect size .25 to .50.** Effect-size improvements have been found of 3.80 for learners who learned in two rooms compared with those who learned in the same room when they were tested in a room they’d never been in before (Smith, Glenberg, & Bjork, 1978, Experiment 1); .22 for two rooms over one room, and .70 for four rooms over one room (Smith, 1982, Experiment 1); .40\(^4\) for learning in three rooms compared with learning in one room (Smith, 1982, Experiment 3); and .28 for learning in four rooms compared with learning in one room (Smith & Rothkopf, 1984). The last two percentage improvements reported did not reach statistical significance. Smith and Vela’s (2001) meta-analysis found seven relevant studies with an average weighted effect size of .45 (a moderate effect size). The estimate for the representative range was lowered to reflect the fact that only a few studies were available and some of them didn’t reach statistical significance.

Does Thinking of the Learning Context Enable Retrieval?

**Representative Range undetermined.** Effect-size improvements have been found of .96 when learners are encouraged to think about the room they learned in compared with receiving no such instructions (Smith, 1979, Experiment 2); .92 for instructions to remember their learning room over no instructions (Smith, 1984). Smith and Vela’s (2001) meta-analysis found ten relevant studies with an average weighted effect size of 0.26 (a moderate effect size). There were too few studies to create a representative range.

Generalizability of Research Findings:

**Medium-Wide.** Context effects have been found using many different types of contexts, including visual, auditory, olfactory, and emotional. However, context effects are not found universally. Fernandez and Glenberg (1985) were among the first to point this out.

---

\(^{4}\) To calculate the Cohen’s d effect size in this case, the MSE for the direct comparison between means was not available, so Cohen’s d was approximated by using the MSE from the full-effects ANOVA.
finding very little evidence for context effects even after eight separate experiments, including a failed replication of Smith’s (1979) Experiment 1. A key distinction is necessary to answer the question about context’s generalizability. Context is generalizable across types of context but not across types of retrieval methods. Specifically, context effects are less likely to happen if other memory cues provide better triggers during retrieval—for example, when multiple-choice tests are used or when learners have to choose from a list of alternatives as opposed to generating their own answers.

Researchers have found context effects more often when learners have to recall information with weak cues than when learners have strong cues to use in retrieving information from memory. Thus, we might wonder how generalizable context effects are to workplace learning. Most performance situations provide weak cues. When we are using our new email software, most of our actions are generated without a list of options (or with a list of options so large that it becomes more efficient to generate our own actions). When we come back from our management-training seminar and we’re running our first meeting with our direct reports, we aren’t given a multiple-choice list of phrases to choose from. Given the fact that workplace performance usually requires us to generate our own action choices, context effects should be considered generalizable to most workplace situations. The big caveat is, of course, that when strong cues are available, contextual cues are usually not utilized, and thus in these situations context can be considered ungeneralizable.

**Priorities for Further Research:**

What we don’t yet know is how specific types of training (e.g., technical, interpersonal, management) and methodologies of training (e.g., multimedia, classroom, on-the-job) can best utilize context effects. It would be useful to know what elements of context have the most impact for each content area, instructional technique, job category, and type of workplace.

Moreover, it would be helpful to know what makes some contextual cues more salient than others. And it would be valuable to know how instructors and/or instructional designers can emphasize aspects of the context (when learning and performance contexts match) and de-emphasize aspects of the context (when learning and performance contexts don’t match).

What is needed now is more applied research. For example, if I were doing classroom training for managers, it would be useful to know how important working on real work problems is in providing a transferable context, how important it is to have fellow employees in the classroom to provide context, and what examples are especially likely to create memory stores that are retrieved by stimuli in learners’ work situations.
In addition to this applied research, it would be nice to know whether context creates its effects because it helps same-context performance or hurts different-context performance.

It would also be valuable to test the conjecture made above about the relationship between the number of contextual cues and the number of learning points. Specifically, does having fewer learning points per contextual cue really improve subsequent retrieval? And if so, how?

Finally, it would be nice to know if context can create a ripple effect. For example, if an odor is released in Room 1 during learning and reintroduced in Room 2 during retrieval, will subsequent retrievals without the odor present in Room 2 benefit from the earlier context effect?
Update for 2009

It’s been almost seven years since I originally finished this report. Since that time, more and more research has confirmed the basic premise—that when the learning and retrieval contexts are aligned, that significant improvements in retrieval are found. Here are some recent findings.

Mandarin-English bilinguals were asked questions such as "name a statue of someone standing with a raised arm while looking into the distance." They were more likely to name the Statue of Liberty when asked in English and the Statue of Mao when asked in Mandarin (Marian & Kaushanskaya, 2007). Learners who learned words while listening to a Chopin waltz in a minor key were better able to remember those words while listening in a minor key versus learning in a major key (Mead & Ball, 2007). People asked to remember memories from their past were more likely to recall those memories two weeks later if their body positions (when asked to recall) matched the memory than when it didn’t (Matching: waving a hand, remembering when you waved at someone. Non-matching: holding your elbows on a table, remembering a memory of playing baseball) (Dijkstra, Kaschak, & Zwaan, 2007).

Intriguingly, three-month-old infants who learned how to move a mobile while smelling a coconut or cherry fragrance were only able to remember that movement one day or five days later when in the presence of the same odor (Schroers, Prigot, & Fagen, 2007). Because this research was done on such young children, we can surmise that context-dependent memory is a fundamental part of our cognitive machinery, not just some cultural or learned artifact.

As before, contextual cues only have an effect if they are sufficiently salient. For example, in an e-learning program, colored borders did not show a context effect (Prestera, Clariana, & Peck, 2005). Different flavors of chewing gum do not always show an effect (Johnson & Miles, 2008).

As before, some encoding conditions (learning situations) were found to be more conducive to learning than others, making context-alignment effects more likely. For example, Cassaday, Bloomfield, and Hayward (2002) found that relaxing conditions induced better learning and more context-dependent remembering. Thompson, Williams, L’Esperance, and Cornelius (2001) found that skydiving—because it can be highly stressful—did not show a context-dependent memory effect. I have a new perspective on this type of finding. I now see learning as having a potential to move from a building-understanding phase to a retrieval-preparation phase. My guess is that while learning new material initially, non-stressful contexts are helpful. Later, to prepare learners for stressful retrieval situations, stressful learning contexts may produce benefits.
Practice Questions

The following set of questions will help you solidify your knowledge of the topic. Ideally, you should wait a day or so after finishing the previous sections before you attempt to answer these questions. Don’t just skim them, but instead, answer them with high levels of attention and intention. Don’t look ahead to the correct answers—such a process will short-circuit your learning efforts. If you really want to supercharge your learning, apply the key learning point of each question to real-world issues. And don’t forget to have fun! These aren’t test questions. They’re practice questions.

Several aspiring park rangers prepare to take the ranger-certification test, which consists of 10 parts. On the tenth part of the test, the candidates are asked to identify plants on the park’s nature trail. Who is more likely to pass the tenth part of the certification test?

A. The candidates who learn plant names in their offices.
B. The candidates who learn plant names on the nature trail.
C. Both will have similar results.

Correct Answer: Fourth Letter: BACBAAC

The park rangers will have to perform on the nature trail, so that is the best context for them to learn in. The cues on the nature trail will become integrated with their memories of what they’ve learned. Later, when they are taking the test, the cues along the nature trail will remind them of what they learned.

“I used to sell these research reports for money, but even though they provided research-validated information from the world’s best refereed journals, not that many people actually benefitted from my efforts. Now, legions are benefitting.”

Want to advertise?
info@work-learning.com
A group of high-school teachers learn a new teaching technique in a room on the local college campus where Madonna’s dance music filters into the room from a nearby aerobics class. Which of the teachers will be most successful in applying the new teaching technique?

A. The teachers who try to apply the technique in their typical classroom environment.
B. The teachers who try to apply the technique in their classrooms while they play quiet New-Age music in the background.
C. The teachers who try to apply the technique in their classrooms while they play Madonna’s dance music in the background.

Correct Answer: Fifth Letter: ACBACBC

Music is context too, so if Madonna’s dance music is heard during learning it will produce retrieval benefits if played during retrieval. In this example, we might also want to consider the effects of the music on the teachers’ students. If we discover that dance music generates inappropriate student behaviors, we might recommend that the teachers listen to Madonna’s dance music using headphones. Similarly, we might not want the students’ learning to be contextually tied to dance music. Or a cost-benefit analysis may suggest that the teachers do without the music. One way to utilize the benefits of context without harming student performance is for the teachers to listen to the dance music while preparing in the classroom. The dance music will aid retrieval during this preparation, and these retrieved thoughts may become associated with the classroom and thus be better retrieved later when the teachers try the new teaching technique with students present. Note that this last suggestion is a logical conjecture but is not one that has been directly tested with research. The qualifiers in this paragraph should remind us that our learning environments are complex and must be considered holistically.
An instructional designer compiles a 20-item test that asks learners questions similar to the ones included in this report, except that the questions use a cued-recall format, not a multiple-choice format. The instructional designer wants to give the test at the end of each topic and at the end of the class as a final summary test to measure learners’ long-term retention. He decides to use the same questions on both the interim topic tests and the final test. What will the final test measure?

A. The learners’ knowledge of the material.
B. The ability of the learners to retrieve the learned material.
C. The ability of the learners to remember the answers they produced on the topic tests.
D. The ability of the learners to retrieve the learned material while being in a context that facilitates retrieval.
E. All of the above.

Correct Answer: Fifth Letter: ECBADEA

On the topic tests, the questions generated answers, which then become associated with the test-question context. When the same test questions are presented to learners on the final test, the context provided by the test question facilitates recall of the previous answers. Thus, the test may not be a good measure of the learners’ knowledge because the learners may not be able to produce the correct answers without the context of the test questions. Let me provide an example. Suppose I ask a question that starts with the sentence, “Several groups of maintenance electricians receive training on a new robotic assembly line.” If my learners see this question again, the words “maintenance electricians” and/or “robotic assembly line” may act as cues that remind them to think about focusing on how realistic the training should be (because this was the gist of the question), providing a major hint about which answer is correct. Of course, if I substituted “ballet dancers” for “maintenance electricians” and “Radio City Music Hall’s Nutcracker Suite” for “robotic assembly line,” there would be very few salient cues from the original question to provide hints and bias the learners’ thoughts toward producing the right answer. Those of you who are still arguing for choice E (“All of the above”), may have a point, but I don’t think choice C is defendable. The test does not measure the ability of learners to remember their answers. What would happen if you didn’t provide the test questions but asked learners simply to recall the answers they gave on the topic tests? They wouldn’t have a clue, or, to put it more precisely, they wouldn’t have a cue.
Several pipe workers receive training on how to work in subfreezing weather in Aroostook County, Maine. All of the workers learn the functioning of the gas and oil lines. Which group will perform better when they start their work in January on the pipelines in Aroostook County, Maine?

A. The workers who learn indoors on a multimedia program that presents realistic pipelines that function similarly to the pipelines of Aroostook County, Maine.
B. The workers who learn in a warm building in Aroostook County, Maine, on pipelines that function similarly to the pipelines of Aroostook County, Maine.
C. The workers who learn outdoors in Aroostook County, Maine, on pipelines that function similarly to the pipelines of Aroostook County, Maine.
D. The workers who learn outdoors in Aroostook County, Maine, on a multimedia program that presents realistic pipelines that function similarly to the pipelines of Aroostook County, Maine.
E. Choices C and D will produce similar results.

Correct Answer: Third Letter: BACEDEA

The group that learns in the most realistic context will perform the best because the closer the learning context is to the performance context, the more retrieval of the learned information will be facilitated.
Office workers at Pogoshtick Elevator Company all sit in identical cubicles and work on identical laptop computers. Workers are permitted to decorate their cubicles with three to five personal items, but otherwise they must each maintain the look and feel of the corporate cubicle. The Information Systems Department is very proud of their work and has recently partnered with the Training Department to purchase and maintain a web-based training program to teach workers how to better utilize the Microsoft Excel spreadsheet program. The Training Department has two special cubicles (almost identical to all other cubicles) that employees can use for the program. People are expected to work on the training program on their own and take the test when they feel they are ready. Substantial monetary bonuses are paid to those who score in the top 25%. Who is most likely to earn the bonuses?

A. Those who learn in their own cubicle and take the test in their own cubicle.
B. Those who learn on their laptop in one of the special training cubicles, and take the test on their laptop in the same training cubicle.
C. Those who learn on their laptop in one of the special training cubicles, but take the test in their own cubicle.
D. All of the above choices are likely to produce equal performance.
E. Choices A and B will produce equally superior results.
F. Choices D and E provide equally plausible explanations.

Correct Answer: Sixth Letter: DACBEFA

Two plausible answers exist. First, one could argue (Choice E) that learners will retrieve more information on the test if their learning workspace and testing workspace are the same. Alternatively, one could argue (Choice D) that because the cubicles are nearly identical, the workspace context won’t produce any distinguishable context effects. One could also argue (Choice D) that because people focus so completely on their computer screens, the cubicle context won’t even be processed and therefore won’t produce context effects. Such a conjecture remains unresolved until researchers determine how much background room context is processed when people use computers. This may be a case where the more compelling the instruction, the less likely the background context of the room will be paid attention to and integrated into memory. This question is utilized despite its complexity to give you practice in evaluating realistically complicated instructional-design situations.
Airline pilots are using multimillion-dollar flight simulators to prepare to fly Boeing 757’s. They are confronted with 100 emergency situations, 50% of which typically end in crashes. Which pilots will be better prepared to handle real emergencies?

A. Pilots who earn $100 for every emergency situation in which they land safely.
B. Pilots who are hooked up to electrodes that deliver a very painful shock when they crash the flight simulator.
C. Pilots whose training copilots, unbeknownst to the pilots, are instructors who yell and scream and go into a panic during most of the emergency situations.
D. Doing B and C together will produce the best results.
E. Doing B or C will produce equally superior results.

Correct Answer: Third Letter: CBDECAB

The emotional mood in the training situation provides a context that becomes intertwined with the content message. It is likely that the fear of receiving the painful shock will cause the pilots to go into a panic during the simulated emergency situations. Having the copilot yell and scream will produce the same result. This fear context will likely be repeated in real emergencies and will help pilots retrieve the appropriate strategies to handle the real emergency situations. Although this recommendation is consistent with information presented in this section, due to the complexity of human nature and the critical importance of air-safety training interventions, it would be best to test such training designs thoroughly before implementing them. For example, it could be that the electric shock causes some form of learned helplessness or severely limits cognitive capacity during learning. The point is that the mood of the learning situation should be similar to the mood of the performance situation. In this case, it might be helpful to analyze real airline voice recorders during emergency situations and then to simulate the mood of those situations with the help of confederates who play the role of other airline personnel, or through other means such as electric shock and loud noise.
The Lady’s Hat Mill operates 25 mills that each grinds about 8 types of grain. The machines require that the millers set criteria depending on the type of grain, its size, dampness, salt content, customer use, etc. Each type of grain (for example wheat, barley, millet) has its own set of criteria, which are displayed on the computer console. Learners must use a realistic computer interface to set the criteria correctly. Which design will produce the best performance on the milling system?

A. Each of the 10 grain-displays uses the same Arial Black type font and has a picture of the Lady’s Hat logo. The training system provides the same displays.
B. Each of the 10 grain-displays uses a distinctive type font and a photograph of the appropriate grain’s plant. The training system provides the same displays.
C. Each of the 10 grain-displays uses a distinctive type font and a photograph of the appropriate grain’s plant. For each of the 10 grain-displays, the training system uses the same Arial Black type font and includes a picture of the Lady’s Hat logo.
D. Each of the 10 grain-displays uses the same Arial Black type font and has a picture of the Lady’s Hat logo. The training system uses a distinctive type font and a photograph of the appropriate grain’s plant.

Correct Answer: Second Letter: ABDACAC

When different contexts can be used to clarify distinctions between different tasks, utilizing these contexts during both learning and performance improves retrieval. In this example, the photographs and the type fonts will act as cues to trigger appropriate thoughts and actions.

Which design will produce the WORST performance on the milling system?

Correct Answer: Sixth Letter: DCABCDA

Learners who learn things in different contexts often become dependent on the contextual cues from those contexts. If those contextual cues are not present when the learners need to perform, their performance will suffer. In this example, learners who get different type fonts and different photographs during learning will not have those cues available during performance and will not perform as well as those represented by the other selections.
Organizational change consultants being hired by BigCheese Consulting need to be trained to work in a variety of industries and workplace situations. Because each client is unique, BigCheese selected recruits on the basis of their creativity. Which apprenticeship design will produce the best consultants?

A. The one that places trainees with 2 clients over two years.
B. The one that places trainees with 8 clients over two years.
C. The one that places trainees with 24 clients over two years.
D. All of the above will produce superior consultants.
E. Choices B and C will produce equally superior consultants.

Correct Answer: Fifth Letter: CBDEBAC

Learners who learn things in many different contexts are better able to handle a variety of performance contexts and requirements and are more likely to produce creative solutions than are those who only have exposure to a few learning situations. In this example, 2 clients is too few and 24 clients is likely to be too many—an average of one a month—a situation that is unlikely to provide the learners with a sense of how a complete client engagement unfolds.

It was the kind of high-profile case that could make a lawyer’s career, and both the defense and prosecuting attorneys wanted to win. After several weeks of testimony from witnesses, the lawyers had finally concluded their cases on Friday. Both worked over the weekend to prepare their closing arguments. Both knew that they would be in Courtroom 11 on Monday, and both wanted to prepare in that courtroom to gain the benefits of context. The prosecutor suggested that the defense attorney could use Courtroom 9 so that he’d be more comfortable in its lavish surroundings. The defense attorney objected, pointing out that Courtroom 11 was quite unique and he wanted the benefits of context as much as she did. They finally worked it out so that they could share time in Courtroom 11. Unfortunately, on Sunday night, a leak in the plumbing severely damaged Courtroom 11 and the judge moved the closing arguments to Courtroom 9. Assuming that the evidence favors neither side, which attorney is most likely to win the case on the basis of their performance of the closing arguments?

A. The lawyer who avoids paying attention to the room surroundings.
B. The lawyer who thinks about Courtroom 11 before and during the summations.
C. The lawyer who avoids looking at his or her notes.
D. Both B and C will produce superior performance.

Correct Answer: Fourth Letter: BACBDAC

By imagining the learning environment, people can facilitate recall of information learned in that environment. Although it might be somewhat effective to avoid
paying attention to the room surroundings, imagining the learning environment, especially when it’s unique, is likely to facilitate retrieval to the greatest extent.

Hewlett-Packard printer technicians are trained to fix over 20 types of HP printers. The key to being able to fix a printer is to quickly determine the model type, recall the likely problems, make a diagnosis, and supply the appropriate fix. Fortunately, each model type looks somewhat different from the others. Which type of training methodology will produce the best performance in fixing problems?

A. The design that encourages learners to use the shape of the printer model to help them make appropriate repairs.
B. The design that doesn’t mention the different shapes of the printer models.
C. Both designs will produce equal on-the-job performance results.

Correct Answer: Third Letter: CBACBAB

By paying attention to the contextual cues during learning, learners can more fully associate the learned information with the contextual cues and thus use those cues to aid in retrieval when they reenter the context later.

A group of Air Force jet mechanics takes a course on the use of safety checklists. They learn the new safety-checklist system and review the dozens of tests they must complete before they let the plane back into action. Which mechanics are likely to carry out the new system with the greatest success?

A. The mechanics who take the course in the hangar where they do their work.
B. The mechanics who take the course in an offsite hangar.
C. Both groups will do equally well.

Correct Answer: Sixth Letter: BACABCA

Contextual cues produce retrieval effects only when other, more powerful cues are not available. In this case, the checklist acts just like multiple-choice-test alternatives, providing more powerful cues than the contextual background stimuli of the hangar. The alternatives provided by multiple-choice tests provide cues that trigger appropriate memory stores. A checklist will do the same thing. When a mechanic sees the checklist item, “Check rear stabilizer bolts,” it will provide enough of a memory trigger to make background context irrelevant.
References Cited


Review Questions

The questions below are the original questions presented in the report. You may find it valuable to answer these questions one to two weeks or more after you finish reading the report. Such a process will help you solidify your knowledge of the topic. Don’t just skim the questions, but answer them with high levels of attention and intention. Don’t look ahead to the answers—such a process will short-circuit your learning efforts. If you really want to supercharge your learning, apply the key learning point of each question to your on-the-job instructional-design issues.

1. Three vice presidents at the Rainbow Company need to prepare a presentation to the board of directors. The person who makes the best presentation will be offered the job of President. All presentations will be made in the Blue Boardroom on Monday. Each candidate prepares carefully over the weekend. Who is more likely to become the new president of the Rainbow Company?

   A. The person who prepares in the Blue Boardroom.
   B. The person who prepares in his or her small office cubicle.
   C. The person who prepares at a log cabin in the mountains.
   D. The setting of the preparation is unlikely to affect performance.

   Correct Answer: Second Letter: DACBDAC

   The person who learns his or her presentation in the room where it will be retrieved from memory will perform the best.

2. A group of data-entry clerks learns a new software program in a training room where the instructor plays Mozart throughout the class. Which of the data-entry clerks will perform better in using the new software?

   A. The clerks who work in a quiet environment with few distractions.
   B. The clerks who listen to the rock and roll of the Rolling Stones.
   C. The clerks who listen to the classical music of Mozart.
   D. Background noise is unlikely to affect the clerks’ performance.

   Correct Answer: Fifth Letter: ADBDCAC

   The clerks who work with the software under conditions similar to those in which they learned it will perform the best. Background noise matters too.
3. Several groups of maintenance electricians receive training on a new robotic assembly line. All of the groups learn the functioning of the assembly line. Which group will perform better when they start their work maintaining the machines?

A. The group who learned by using a working facsimile of the assembly line, including a simulation of the electronic circuitry.
B. The group who learned by using a computer-generated simulation of the electronic circuitry of the assembly line.
C. The group who learned by using the traditional schematic drawings of the electronic circuitry of the assembly line.
D. All of the above will produce similar performance results.
E. Both A and B will produce equally superior results.

Correct Answer: Fourth Letter: ECBADEA

The group that learns in the most realistic context will perform the best. The closer the similarity between the learning context and the performance context, the more the cues in the performance context will generate the retrieval of the learned information.

4. Two supervisors at the Rainbow Company need to prepare a presentation to give to their teams to get them motivated to work on a reengineering effort. The team of the supervisor who makes the best presentation will perform better, will be more satisfied with their work, and will receive more lucrative year-end bonuses. Both supervisors recently took a leadership course and are planning to study their notes to help them prepare for the meeting. Both of the presentations will be made in the Blue Operations Room on Monday. Both supervisors want to use the Blue Operations Room over the weekend to prepare, but since they can’t use the room at the same time they agree to flip a coin. The winner will use the Blue Operations Room; the loser will use the Red Operations Room, a nearly identical room next door—except for the color. Each of the candidates prepares carefully over the weekend. Which of the supervisors is more likely to move their team to greater success?

A. The one who prepares in the Blue Operations Room.
B. The one who prepares in the Red Operations Room.
C. Both are likely to perform equally well.

Correct Answer: Fourth Letter: ACBCBAA

Because the rooms are almost identical, any differences in performance due to context effects will be minimal. Having only a few things that differ (in this case the color of the room) is unlikely to produce context effects.
5. Employees go to an off-site training program where they learn interpersonal communication skills in a happy, rewarding, and almost joyous environment. When they return to their work environment, they face different emotional cultures in their various departments. Which departments are most likely to utilize the new communication skills?

A. The relationship between the mood in the training and the mood in the workplace has very little to do with on-the-job performance of trained skills.
B. Departments that maintain the happy, rewarding, and joyous environment are most likely to use the new skills.
C. Departments that return quickly to their normal work mood are most likely to use the new skills.

Correct Answer: Third Letter: BCBACAB

Mood is context too. The emotional mood in the training room provides a context that becomes intertwined with the content message. When the mood in the performance context is similar to the mood in the training context, it reminds learners of the training context and thus aids retrieval.

6. A computer-based tutorial is created to help clerical staff master the new accounting system. The tutorial enables learners to practice using a realistic simulated version of the accounting system. There are 12 forms in the accounting system that must be learned. Which design will produce the WORST performance on the accounting system?

A. Each of the 12 forms in the accounting system uses a gray-blue color scheme. The tutorial has the same gray-blue color scheme for each form.
B. Each of the 12 forms in the accounting system uses a different color scheme. The tutorial uses a gray-blue color scheme for each form.
C. Each of the 12 forms in the accounting system uses a gray-blue color scheme. The tutorial uses different color schemes for each form.

Correct Answer: Fifth Letter: ABBACAC

Learners who learn things in differentiated contexts often become dependent on the contextual cues from those contexts. If those contextual cues are not present when the learners need to perform, their performance will suffer severely.
7. Managers in a high-tech company known for its flat organizational structure and its extensive use of cross-functional teams are trained in leadership skills. The work environment regularly challenges the workers to deal with different situations and different people. Which training design will produce the best leaders?

A. The training that utilizes five different training rooms and five instructors.
B. The training that utilizes one training room and five instructors.
C. The training that utilizes five different training rooms and one instructor.
D. The training that utilizes one training room and one instructor.

Correct Answer: Sixth Letter: CBBACAC

Learners who learn something in many different contexts have multiple cues they can use to aid their memory retrieval and thus are able to perform in a wider variety of situations.

8. Three associates at the Rainbow Company need to prepare a presentation to the board of directors. The person who makes the best presentation will be offered a year-long sabbatical to study the impact of the Internet on the Caribbean beach economy. All presentations will be made in the Blue Boardroom on Monday. Each candidate prepares carefully over the weekend. Who is more likely to spend a year lying on the beach sipping delicious exotic beverages?

A. The person who prepares in the Blue Boardroom.
B. The person who prepares at a log cabin in the mountains.
C. The person who prepares in the Blue Boardroom, and thinks about the Caribbean beach environment immediately before giving the presentation.
D. The person who prepares in the mountain cabin, and thinks about the mountain cabin immediately before giving the presentation.
E. Both A and D will produce similar performance during the presentation.

Correct Answer: Sixth Letter: EACBDEC

By imagining the learning environment, people can facilitate recall of information learned in that environment.
9. A computer-based tutorial is created to help clerical staff master a new accounting system. The tutorial enables learners to practice using a realistic simulated version of the accounting system. There are 12 forms in the accounting system that must be learned. Each form is designated by a different color. For example, there is a pink invoice form, a yellow expense form, a blue accounts-payable form, and so forth. Which training design will produce the best performance on the accounting system?

A. The design that encourages learners to use the color context to help them learn the various forms.
B. The design that doesn’t mention the different colors.
C. Both A and B designs will produce equal on-the-job performance results.

Correct Answer: Sixth Letter: BACBCAC

By paying attention to the contextual cues during learning, learners can more fully associate the learned information with those contextual cues. Later in the on-the-job situation, the contextual cues will aid the retrieval of the learned information.

10. A group of computer operators take a course on the topic of computer security in the company’s luxurious executive training room. They are all preparing to take a national credentialing exam in one month. The exam consists of 100 multiple-choice questions and will be given in the executive training room. Which person is likely to do better on the exam?

A. The person who studies the course materials in the executive training room.
B. The person who studies the course materials in his own office.
C. Both will do equally well.

Correct Answer: Fifth Letter: ACABCAB

Contextual cues produce retrieval effects only when more powerful cues are not available. In the question above, the multiple-choice alternatives in the test provide more powerful cues than the contextual background stimuli in the executive training room.