

Variable and Blocked Practice

How these Contrasting Techniques Shape Learning

by Cynthia Pace

There are countless ways to practice, each with its own purposes and strengths. But even mild differences in organization—for instance, repeating the same thing several times vs. alternating it with a mixture of other things—can dramatically impact long-term results.

The two techniques of “blocked” and “variable” practice have lately become “hot” conversational topics, particularly in sports and academics. In musical practice, these contrasting approaches have long held a place, though they are seldom labeled by name.

In comparing approaches, we’ll find that, generally, one produces more immediately noticeable results, and the other better promotes long term learning-retention. To help with deciding where and when to use each, we’ll look at some recent research to explain why each approach tends to get the results that it does.

Blocked Practice:

Blocked practice is the time-honored means of organizing practice, where we repeat the same thing a number of times before going on to the next thing.

For example, a student might repeat one piece four times in C major, then move on and repeat another piece four times in G major.

BLOCKED PRACTICE- *One Thing at a Time*

SKIPS AND STEPS

- Each day “skip” the marked numbers for one or two days (the right number). Once you do, skip the required pattern and the skip.
- Find your place on the keyboard, then skip and play the target numbers.

Left Hand Teacher's Music Right Hand

1st Piece

- C Major
- C Major
- C Major
- C Major

SWINGING

Do not rock the key.

- Keep the finger number as you “skip” the marked pattern in the air. “Swing” the step and raise repeated tone.
- Find the “swing” of the melody by swinging the melodic line (left) or the chord (right).

Left Hand Teacher's Music Right Hand

2nd Piece

- G Major
- G Major
- G Major
- G Major

Blocked practice helps with such things as:

- getting a basic “feel” for something new,
- touching up and polishing,
- developing speed, accuracy and reflexes for technically difficult passages.

Blocked practice can readily apply to virtually any practice situation.

Variable Practice:

Almost the opposite of blocked practice, is “variable practice,” which avoids consecutive repetition of the same thing. Instead, as the name implies, every go-through is followed by something different.

Variable practice (also called “interleaved practice”) comes in many forms. For instance, students can modify an item on each play-through, by changing its dynamics, contouring, touch, timing, key, and so on. When students play “Skips and Steps” one time in each key of G, A, D, and Db major, and then “Swinging” in C, D, A, Ab, they are applying variable practice. (These are the keys indicated by *Music for Piano* and companion book, *Creative Music*, Level 1, pgs 4-5.)

VARIABLE PRACTICE- *Different Each Time*

Music for Piano 1, Pg. 4

SKIPS AND STEPS

1. Look for “steps” the melody pattern in the air as you sing the finger numbers.
2. Also, notice the skips, the repeated pattern and the repeats.
3. Find your place on the keyboard then sing and play the finger numbers.

MELODY PATTERN Left Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1
 MELODY PATTERN Right Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1

3. Play “Skips and Steps” again on these keys:

Left Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1
 Right Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1

Creative Music 1, Pg. 4

SKIPS AND STEPS

1. This melody has skips, steps, and a repeated pattern.
2. Think the “steps” the melody pattern in the air as you sing the finger numbers.
3. Find your place on the keyboard then sing the finger numbers as you play it.

MELODY PATTERN Left Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1
 MELODY PATTERN Right Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1

3. Play “Skips and Steps” again on these keys:

Left Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1
 Right Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1

◀ Skips & Steps ▶

- G Major
- A Major
- D Major
- Db Major

Music for Piano 1, Pg. 5

SWINGING

Do this each day:

1. Sing the finger numbers as you “step” the melody pattern in the air. Notice the steps and one repeated note.
2. Find the “swing” of the melody as you sing the numbers and play it on the piano keyboard.

MELODY PATTERN Left Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1
 MELODY PATTERN Right Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1

3. To play “swinging” in another place, move each finger to the right and put your 1st finger on a black key:

Left Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1
 Right Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1

Creative Music 1, Pg. 5

SWINGING

Do this each day:

1. Sing the finger numbers as you “step” the melody pattern in the air.
2. Notice the steps and one repeated note.
3. Find your place on the keyboard then sing the finger numbers as you play it.

MELODY PATTERN Left Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1
 MELODY PATTERN Right Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1

3. Play “Swinging” again in this new place:

Left Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1
 Right Hand: 1 2 3 4 5 4 3 2 1 2 3 4 5 4 3 2 1

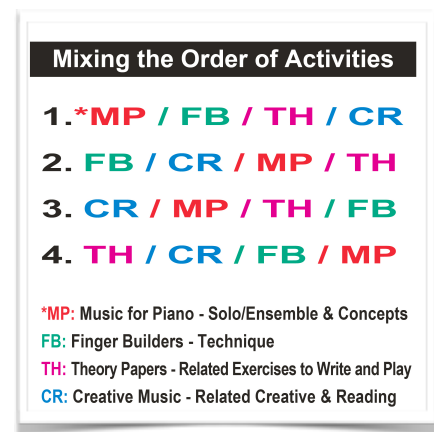
◀ Swinging ▶

- C Major
- D Major
- A Major
- Ab Major

“Variable Variants”:

An interesting form of variable practice is when we intermix different activities within a field of study, instead of varying one particular thing. Researcher Cheryl Coker calls this “intratask” vs. “intertask” variation.¹ An example of intertask variation would be if a student were to:

- play once through a “tricky” passage of a new piece,
- then do some technique, or play a chord progression, or write a theory exercise,
- sightread or transpose,
- improvise or compose.



If the student were to go through such a sequence four times, changing its order every time, each activity would receive four non-consecutive repetitions. This is called “random” practice.

Random practice can be adapted for different ages and levels by shortening or lengthening excerpts/activities and numbers of repetitions; mixing together variable, blocked practice and other techniques; and so on. Students enjoy picking their own order for practicing items. If needed, they can use check-marks, tallies, game pieces, etc., to keep track of what they practice.

Comparing Results - Tortoise And The Hare

Not surprisingly, we usually find that:

- blocked practice is easier, and
- variable practice is more challenging.

It’s relatively easy to block-repeat something several consecutive times, and to see a noticeable gain in fluency while playing. On the other hand, with variable practice where each thing we practice differs from what just preceded it, a bit more mental effort and time is required. Moreover, no one item tends to show as much immediate improvement as it might during blocked practice—at least early on.

Clearly, the more different items there are to practice, the less available time there is for practicing any one item. Thus, with variable practice, things may improve in comparatively smaller steps. But, as researcher Robert Bjork points out, “over time, *the sum of these small*

steps is much greater than the sum of the leaps you would have taken if you'd spent the same amount of time mastering each skill in its turn."[italics added]²

How Does Variable Practice Better Promote Long Term Learning?

Recall Is Continuously Exercised Through Variety

According to a wide body of research, *variable practice far surpasses blocked practice in promoting long term, adaptable learning*. In part, this is because variable practice rehearses recall more often than blocked practice does. That is, students must constantly call to mind what to practice at every go-through of variable practice, because each go-through differs from the immediately preceding one. The more often an item gets recalled, the more recallable it becomes in the future.³

By contrast, blocked practice infrequently brings recall into play. When block-practicing the same thing over and over, students can imitate the item automatically after it's been played the first time, without need to pay much attention to what they are actually playing. Only when students play the first item of a new sequence of repetitions, do they fully exercise calling to mind what they will play. Variable practice acclimates students to recalling something in many different contexts. Blocked practice reinforces one context only.

Mixed Practice: More Anchor-Points

When students practice a piece by transposing it to C, D, A, and Ab, as in the earlier example, not only do they encounter four white/black key combinations (instead of one), they also gain an opportunity to compare the sound, feel, and technique for these keys. The likenesses and differences that students note, provide ways to connect what they are learning, to other new as well as already-learned elements. As this example illustrates, practicing mixtures of items thus enlarges students' network for anchoring and storing information and skills in memory.

Missing Out On Advantages Of Variable Practice

Variable practice and certain other learning modes pose challenges that seem to slow learning-time. Nonetheless, these lead to greater long term learning retention. In developing this idea, Bjork has named such challenges "*desirable difficulties*."⁴

The belief that any degree of extra difficulty or complexity indicates weakness in a learning technique, sometimes leads us to miss out on the advantages of variable practice. The idea that learning can be improved by "complicating" practice with variables, instead of limiting these, can seem illogical and contrary to day-to-day experience. In fact, numerous studies comparing

variable and blocked practice have documented that a majority of their research subjects believed mistakenly that blocked practice had benefitted them more during research testing. The research proved, to the contrary, that variable (interleaved) practice was most effective for the preponderance of participants⁵

In discussing the difficulties of assessing teaching and learning approaches, researcher Jeffrey Bye observes that common assumptions often lead us to conclude that:

The approach which leads to the most immediate and observable signs of student improvement is the best one. In fact, when teachers try to facilitate learning by making it as easy as possible, this may increase the immediately observable short-term performance, but it decreases the more important long-term retention. In short, we often seek to eliminate difficulties in learning, to our own detriment.⁶

Varied Practice: Learning Dilutant Or Learning Enhancer?

The broad-scope nature of variable practice raises the question, “Do we dilute the learning of specific skills and information, by attending to many things instead of focusing on one thing at a time?” A compelling answer to this question is found within studies that have researched advantages in practicing a skill under the exact conditions at which it will be tested (performed). One such study examined the pros and cons of having study participants practice throwing-skills at the same distance at which they would ultimately be tested. Bjork notes the counter intuitive aspect of the findings:

Common sense would suggest that the children who practiced at the tested distance would perform better than those who had never practiced at that distance, but the opposite was true....*The benefits of variation...outweighed any benefits of being tested at the practiced distance* [Italics added]....Many other studies have shown that when testing after training takes place under novel conditions, the benefits of variation during learning are even larger.⁷

Blocked practice focuses us on what we need to do for a particular situation. By contrast, variant-based practice shows us a larger picture that includes differences (and similarities) in how we need to respond to one set of conditions or another. Beyond this, it rehearses us in adjusting for changed conditions.⁸ As study results demonstrate, rather than watering down learning, practicing under a range of conditions better fortifies students for new situations, than practicing at just the specific conditions they will encounter.

Matching Practice Techniques To A Curriculum

Blocked and variable practice are just two of many complementary techniques. All are tools of a set, to be modified and combined in limitless ways.

The appropriateness of any technique depends on many things. During a lesson, a challenge that may excite a student at one point, can at another time be overwhelming or frustrating. Seasoned teachers continually watch their students' cues. Are they energized, intrigued, involved; are they within reach to “get” the material? Or, are they instead perhaps, drifting, tired, hungry, not feeling well, or in some other way distracted? Time, then, to momentarily let up, and do something already well mastered, easier, or lower key. So, too, for students at home. Knowing several ways to practice, can help them apply the “best fit” when needed at a particular time.

Blocked Practice: Dedicated Focus

Blocked-practicing, by isolating and honing in on one thing at a time, can:

- help develop speed and accuracy,
- build short-term recall, and
- reinforce a basic sense of a piece or skill.

Since it requires no particular context, i.e. needs no other materials to intermix with, this technique readily applies within virtually any musical curriculum or situation.

Variable Practice: Lasting, Adaptable Learning Through Diversity & Over-Arching Connections

By contrast, variable practice does not work in isolation, but instead, by intermixing various items. In variable practice, our attention to any one thing is interrupted as we attend to another, then later return to call up the first thing again. Variable practice:

- introduces a wide range of information and skills,
- provides multiple means for interconnecting and storing new learning,
- gives a big picture of skills and information that equips students to successfully meet new situations and challenges,
- encourages awareness of similarity and difference that helps “students acquire a feel for nuance” and, in turn, contributes to sensitive musical expression,⁹
- exemplifies and promotes creativity,
- rehearses recall and promotes lasting, adaptable learning,

In summarizing the importance of including in our teaching and studying, those practice and instructional methods that most effectively instill long term learning, Bye states:

Education is supposed to be about teaching knowledge and skills that students will use throughout their lives. So it should go without saying that teachers should utilize methods that facilitate long-term retention...¹⁰

Theorist Jerome Bruner has long affirmed the importance of concept and spiraling learning that intertwines new and previously learned information, through ongoing reapplication and extension. Bjork, too, notes that to be most effective, variable practice requires that “skills you interleave, are related in some higher-order way.”¹¹

Because effective variable practice involves intermixing of elements that are *diverse yet interconnected*, curricula structured on these same principles naturally suit themselves to this mode of practice. The broader a curriculum’s range of material and activities, and the more comprehensively it interconnects these elements through over-arching concepts, the more seamlessly it lends itself to the benefits of variable practice.

Beyond “Mental Resistance-Training”—Generative Creativity

The adage that things worth doing are worth the effort, is a point well taken, along with that of Bjork’s “desirable difficulty.” Variable practice and other such techniques should not be dismissed on the basis that challenge has no place in learning. While material can certainly be beyond the reach of a student, the converse is also true. Material can be oversimplified to the point of restricting students’ means for making important connections to other knowledge.

Variable practice is inbuilt to the Pace curriculum, and this contributes to the approach’s well-known success in facilitating lasting, adaptable learning. But the idea that variable practice is simply a source of “mental resistance-training” is far from why variation is an underpinning of the Pace curriculum.

Robert Pace viewed creativity as organic to all aspects of musical knowledge, and not as a frill or means to some other end. Encoding learning, though important, was not the primary purpose of variability in the curriculum he structured.

Riffing, taking off, extemporizing spontaneously, expanding upon, modifying and transforming material and skills are essential to the Pace Series because variation fosters and is part of creative experience. Variety and diversity in the Pace curriculum redirect difficulty into challenge, and effort into energized interest, excitement, and fun. “*Desirable difficulties*” turn into “*creative opportunities*” that promote long term learning, but much more, too: When musical expression transcends the sum of its parts, it is due, in no small way, to the generative nature of creative opportunities.

Notes

¹ Coker, Cheryl A. (2009). Motor learning & control for practitioners. Scottsdale, Ariz: Holcomb Hathaway. Chapter 9.

² Sundem, Garth. (January 28, 2012). How To Learn -- From Robert Bjork, Director Of UCLA Learning And Forgetting Lab. Excerpted from *Brain Trust: 93 Top Scientists Dish the Lab-Tested Secrets of Surfing, Dating, Dieting, Gambling, Growing Man-Eating Plants and More* (Three Rivers Press, March 2012).

³ Karpicke JD, and JR Blunt. (2011). "Retrieval practice produces more learning than elaborative studying with concept mapping". *Science* (New York, N.Y.). 331 (6018): 772-5;

Bjork, R. A. (2013). Desirable difficulties perspective on learning. In H. Pashler (Ed.), *Encyclopedia of the mind*. Thousand Oaks: Sage Reference.

⁴ Bjork. Desirable difficulties perspective on learning.

⁵ Birnbaum, M., Kornell, N., Bjork, E. L., & Bjork, R. A. (2013). Why interleaving enhances inductive learning: The role of discrimination and retrieval. *Memory & Cognition*.

⁶ Bye, Jeffrey K. (January 4, 2011). Desirable Difficulties in the Classroom Education. *Psychology in Action*.

⁷ Bjork, E. L., & Bjork, R. A. (2011). Making things hard on yourself, but in a good way: Creating desirable difficulties to enhance learning. In M. A. Gernsbacher, R. W. Pew, L. M. Hough, & J. R. Pomerantz (Eds.), *Psychology and the real world: Essays illustrating fundamental contributions to society* (pp. 56-64). New York: Worth Publishers.

⁸ Motor Learning and Performance With Web Study Guide - 4th Edition: A Situation-Based Learning Approach by Richard A. Schmidt and Craig A. Wrisberg. *Human Kinetics*; 4 edition (October 19, 2007, pg. 272.

⁹ Pace, Cynthia (Nov/Dec 2011). Author Response. In *Clavier Companion Magazine* (p. 46).

¹⁰ Bye, Jeffrey K. (January 4, 2011).

¹¹ Sundem. How To Learn