

MOOC EDSCI1x | Video 4: Spacing and Interleaving | Effective Teaching Strategies

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SUMMARY

The discussion emphasizes the importance of spaced practice in education, highlighting that deep and lasting learning occurs over time with opportunities for feedback and reflection. It critiques the prevalent use of cramming among students, which leads to fragile knowledge retention, and advocates for curriculum design that incorporates spaced practice and interleaving to enhance long-term understanding.

- *Spaced practice is essential for developing enduring and transferable knowledge.*
- *Cramming, or massed practice, is commonly used by students but leads to poor long-term retention.*
- *Research supports that distributed learning over time is more effective than intensive, short-term sessions.*
- *Curriculum design should prioritize key concepts and skills, spreading their learning over time.*
- *Interleaving—mixing different subjects or topics during learning—enhances retention and understanding.*
- *Regular retrieval practice and cumulative testing reinforce past learning and signal its importance.*
- *Students should be educated about spaced practice to manage frustration and understand its benefits.*
- *Both spaced practice and interleaving are crucial for developing expertise in any field.*

- Think of something you know really well, something you have deep knowledge of and are confident you could apply effectively in different contexts. How did that understanding develop for you? Chances are in whatever way it happened it probably took quite a bit of time. That's how deep and enduring learning develops. It's almost invariably distributed over long periods of time with ample opportunities for feedback and reflection. This is called spaced practice.

A learning principle

we're all familiar with, both in our academic and daily lives, yet in schools it's a learning principle we frequently forget or ignore. Too often our students, especially as they make their way through school from K to 12, are taught in ways that run counter to what we know to be best practice for creating long-term learning. Surveys indicate that the most frequent way for students to study, especially in junior high and high school, is called massed practice or more commonly cramming.

This usually involves students intensively studying over a short period of time, often the night before they have a test. What happens next compounds

the problem of cramming. That's because many times the students end up doing okay or even more than okay on the test. It turns out that our human memory is pretty good at retaining a surprising amount of information for short periods of time. That's the problem. The knowledge is retained for only short periods of time.

Give those students the same test three weeks later unannounced and see how they do. My experience is that those same students who achieved high scores retain little of what they knew a few weeks earlier. Even more interesting would be to have students take their final exam from June the following September. You could even limit the important skills and concepts from the previous year. How do you think they would do? The problem of fragile knowledge, as the physicist Richard Feynman called it years ago, is a common one in our schools.

This is because for the most part we don't seem to value learning that creates lasting and transferable understanding beyond the immediate. If so, we would place front and center the principle of spaced practice as we design curricula, instruction, and assessment. Surprisingly, one of the oldest and most powerful research basis in cognitive science has to do with just this learning principle. For over a century, numerous studies have demonstrated that distributing learning over time in relatively short intervals is a much better way to develop enduring and usable memories.

This is in comparison to devoting the same amount of learning time in less frequent and longer sessions or even in single intensive sessions. The principle of spaced practice is one of the most important for long-term learning. That's in addition to of course the principle of active learning or thinking to learn as we have described throughout this course. Spaced practice applies to children and adults of all ages for any subject and it's useful for memorizing basic facts in addition to learning complex skills and high order thinking.

Lets now talk about how this principle applies to designing curricula, choosing teaching strategies and planning homework. Recall, however, that our basic operating assumption is that we want to create long-lasting and transferable understanding for students. The first move in applying the concept of spaced practice is to identify the most important concepts and skills you want your students to

walk out of your class, department, or school knowing, what's most worth learning for the future for every learner.

This will then provide a sense of priority and focus for what is to be learned in a distributed way. It's also the first step in what Grant Wiggins calls backward design. And it will prevent you from suffering the futility of trying to teach everything of importance as he puts it. It will also prevent, hopefully, the student corollary of the futility of forgetting almost everything of importance. Spaced practice has implications for how you plan the sequencing of priority concepts and skills in your course over time.

Instead of teaching a concept or skill intensively over days or weeks as a unit, better would be to plan spreading the learning of the most important concepts over months, returning to them periodically to build and reinforce. This lends itself to a companion spacing principle called interleaving. We discussed this previously in the student learning strategy section of this course. Recall that interleaving involves spending some time learning one thing, then pausing to concentrate on learning a second thing, then returning to the first thing and possibly starting to learn a third thing, all occur without fully learning to completion any one of those subjects.

This sounds confusing, but it works, especially if you're a good planner who can keep track of lots of things. As you can see from this English class example, a teacher could block the four elements of their course and teach each consecutively in a concentrated way. Instead, this teacher has chosen to interleave the topics in a way that makes sense for the material and the students she's teaching. She might even teach a given topic a few days in a row.

It all depends on the subjects at hand and how they build on one another. Also important of course is how well her students are grasping the material. The research is strong about how interleaving enhances learning in a spaced practice way. In the session on student learning strategies, we talked about the benefits of interleaving, but it's just as effective as a tool for curriculum design and instruction. With regard to teaching strategies, intentionally and

frequently having students try to recall past learning is important, especially for the skills and knowledge you want to prioritize.

You can conduct mini reviews periodically in class, asking students to harken back to important concepts learned weeks before or to practice important skills learned earlier. This need only take five or so minutes of class time. Combined with retrieval practice, you have a very potent duo of in-class learning strategies. It's hard to beat spaced retrieval practice to increase student learning. For homework, you can include questions or problems that require students to reflect back on previous learning.

Again, the effect is amplified when coupled with retrieval practice. In testing, make your exams, when feasible, cumulative. You can tell students that any given test might include not only current material, but also past material. It's important that students know in advance the most important skills and concepts that will be included from past tests. This means they need to have a clear sense of what the priority skills and knowledge include. Also test the students unannounced on previous learning.

Occasionally regive parts of a test taken weeks before, focusing on the important prior learnings. Don't tell them ahead of time, but alert students at the beginning of your course that you will retest and explain the reason for retesting. By doing this, you're signalling that you value long-term learning and you're also highlighting learning priorities and at the same time devaluing the short-term learning benefits of cramming. In addition, it can provide useful information for you about what your students are retaining in enduring ways.

Make sure you speak to your students about spaced practice and interleaving. They can get frustrated doing it especially at first because they feel like they're not mastering anything. Also explain to them that concentrated focus on a single topic can provide an illusion of mastery in the short term, but not in a lasting way. One final note. Sometimes spaced practice is offered up as a way to simply memorize things in a knowledge on call way. That may be true, but as we all know, effective critical thinking, problem solving, and decision making all require ready access to critical information and knowledge.

In addition, as the work of Anders Ericsson about how experts are made reveals, one of the crucial factors in their development is deliberate practice extended over long periods of time. Both spaced practice and interleaving are integral to becoming an expert in any field or endeavor. As teachers, we may not be developing world class experts, but we surely can model our practices after their techniques.