



TEACHING FOR STUDENT SUCCESS

Episode 7

Learning Is A Skill: Why do we keep it a secret? with Mark McDaniel

[MUSIC PLAYING] STEVEN ROBINOW: Welcome to Teaching for Student Success. I'm Steven Robinow. Today we will talk with Dr. Mark McDaniel, author of *Make It Stick*, about learning and the importance of recognizing that learning is a skill, a skill that can and should be learned, a skill that can and should be taught.

A variety of researchers study how people learn. There are reams of data about the effectiveness of various learning strategies. We have evidence about which strategies are more effective than others. We certainly don't know everything there is to know about learning, but we know quite a bit, and this knowledge can and should help students succeed.

Yet we enroll students in schools and we expect students to learn without ever teaching them effective learning strategies. Why are we keeping these strategies a secret? Why do we expect our students, our children to discover effective strategies for learning on their own? In this episode, Dr. McDaniel will discuss a new proposal, a new framework for how we might teach students to learn and how to apply this knowledge about learning, giving our students, all students, our children, all children the skills they need to learn efficiently and effectively.

If you are interested in how you can really help your students succeed, how you can help your students become lifelong learners, how you can help your students learn the skills needed for learning, then please listen to this episode. Welcome, Mark. Thank you so much for joining us on Teaching for Student Success.

MARK MCDANIEL: Hi, Steve. I'm really happy to be doing this.

STEVEN ROBINOW: Thank you so much. Dr. McDaniel is a professor in the Department of Psychological and Brain Sciences at Washington University in St. Louis, Missouri, and serves as the director of the Center for Integrative Research on Cognition, Learning, and Education. Dr. McDaniel has received numerous awards. Just to mention a few, in 2019, Dr. McDaniel received the Washington University Outstanding Faculty Mentor Award. The year prior, he received a Lifetime Achievement Award from the International Conference on Perspective Memory.

Dr. McDaniel has published extensively on memory and learning. His research has been funded by numerous private foundations, the National Science Foundation, and a variety of institutes of the National Institutes of Health. Oh, and let's not forget about NASA. In this episode, I look forward to a discussion with Dr. McDaniel of his 2020 paper entitled "Training Learning Strategies to Promote Self-Regulation and Transfer: The Knowledge, Belief, Commitment, and Planning Framework," published in *Perspectives on Psychological Science*.

So now let's talk about your paper. What drove me to this paper initially was there's a lot of focus on implementing evidence-based practices in the classroom. And so things faculty can do to make a more engaging learning environment for students to improve student success. Because hopefully what we're all really here for is that our students succeed.

This paper, however, focuses on the student side of things, and what we have failed to do to them through the educational system in terms of training them and providing with them good frameworks for learning so that they know how should I study and what should I do?

So I'd like to throw the microphone over to you and ask you to, I guess, first lay out the problems, and then we'll get into a discussion of your—the problem that students are currently having with learning. And then move on to what you're proposing in this paper.

MARK MCDANIEL: Well, Steve, a major problem with many human learners is that figuring out effective ways to learn and remember information is not intuitive. Our brains tend to use signals or cues that are misleading in terms of allowing us to judge what effective learning is. As a consequence, many, many learners do not on their own discover effective learning techniques. Many times, techniques that are more effective than what students happen on to on their own are judged by students to be less effective.

Almost every week, every month I see papers on this where students tried a couple of different strategies, they rate one strategy. Usually it's a strategy that seems easier. They rate that as more effective. And objectively, however, what happens is, the strategy that's rated as least effective and also usually is more difficult turns out to be much more effective.

So we're in this situation, Steve, where many learners are trying to do better, they're trying to improve their learning strategies, but the brain is sending them signals that are completely contrary to the strategy that's going to work better.

Now, couple that with the fact that our educational system has virtually ignored the premise or the idea that learning is a skill and that there are strategies that one can adopt to improve that skill, our curriculum is centered around, here's what the student needs to know, and we'll, in the best way we can, present that information. Instructors are getting more and more skilled at this.

But nobody poses the question of, should we help students with how to learn? As a consequence, students are in these probably many times fabulous classrooms, and then they go home and the burden is on them to learn the material. It's not a burden, that's the way it is. So now we're spending lots of time improving our instructional devices, but the fact remains that students have to go home and they have to spend time working on learning.

If they're using inefficient techniques, what we're seeing happening in the seventh grade, eighth grade levels is students start to become disenfranchised with school. In fifth and sixth grade, teachers tell me that students get a lot of support in learning, a lot of exercise and so on, but by seventh or eighth grade, it's up to the student to prepare for the exam.

Some students start to feel like they're not a good student. School is not for them. Really, I think that's a shame, because it's a matter of helping students acquire the skills so that they can learn effectively. And it's a shame because a lot of students are working very hard, but they're not seeing the success that they want. And it's no wonder—they're not using very effective strategies, so of course they're not going to see the success.

And what I like to say, Steve, is that can you think of any domain in which we just throw children into the situation and say, do it, and expect them to be successful? We don't do it in music, we don't do it in sports, we don't throw them into the deep end of a swimming pool and say, get to the side. I mean, some are going to drown. And that's what's happening in our educational system. Many students who could be good students are drowning because they just simply don't understand the way to learn.

So that's the genesis of this paper is to say, we need to help students become better learners. The proximal stimulus for me to really start thinking about training learning strategies was a course applying cognition to education. They're mainly—they were mainly seniors. A lot of what we talked about was, here are the better ways to learn. Here the ways that produce good retention, good learning.

Every year, students say to me, why didn't someone tell me about this when I was younger? So I had to struggle to figure out some of the stuff, and some of it I still don't—still didn't know until we covered it in class.

So that was really the proximal stimulus to say, gosh, if WashU students, who are some of the best students that I've ever taught, by the time they're seniors they're still—I'll say this, but it's not based on a lot of objective evidence, but they might be using brute-force methods and they could be using more effective methods to create learning instead of memorization. But they're not because nobody has informed them. Some figure it out, some do not.

STEVEN ROBINOW: Right. So these are self-taught, self-learned methods. These are students that largely succeed and have figured out how to do it without instruction in evidence-based practices that people study and think about. I mean, there are people that do research. Although in this area, although what you point out in your paper is that very little research is done in this area in terms of transferring the knowledge to students about how to study. You point that out, that there really aren't a lot of studies done in this area.

MARK MCDANIEL: Right. A big portion of the learning strategy training in the middle and high schools is training that's situated within a particular topic. So it may be situated within math, it may be situated within civics—or a lot of times language arts. And so these strategies are pretty specific to the material—they're very specific to the material.

And the most effective training programs are ones in which teachers reinforce and cue students to use these strategies throughout the semester. And I think that's fine. The problem is that many times students don't generalize these strategies and they don't self-regulate them. By that I mean, they don't initiate use of the strategy on their own. Instead, they've become dependent on an instructor to stimulate the use of the strategy.

So what can happen—and this happened at WashU, is that in our chemistry classes, WashU the instructors are fairly good about talking to students about effective strategies. So for example, to learn to solve a chemistry problem, try to explain why you're taking each particular step. And the instructors will cue students to do that.

So in the second term when Gen Chem II starts, one of the students came to the instructor and said, those strategies you taught me for Gen Chem I were very useful, can you tell me what I should be doing for Gen Chem II? Well, they're very closely related, you would use the same strategies, but this is the problem.

If you train these strategies completely within the context of content and the teacher is cuing their use, sustaining those strategies and transferring them becomes quite brittle. So my thinking is that it could be very profitable to teach students some general strategies that are useful across content areas. And maybe it's timely for that now,

because those are things that we've been working on in the past 15 years and uncovered some good general strategies.

We now know some strategies are pretty general. And the ideas, if the strategies are general and you teach them to students, now the student can self-regulate the use of those strategies for all of their courses.

So then I developed a learning strategies course, built it around the knowledge, belief, commitment, and planning framework. And one of the students at the end of the semester, we finished at the end of the spring. He came into my office the first week of the fall. This was before COVID. And he seemed very upbeat, and I said, well, you're very upbeat, very excited. He said, I absolutely am, because thanks to the course we had last spring, I'm now confident that I can meet any learning challenge in any course I take here at WashU, and that's exactly what we're striving for.

Now I'm not saying every student necessarily shared that or maybe even thought that to be the case, but to have that happen reinforced my belief that we're on the right track with this.

STEVEN ROBINOW: That's fantastic. I want to come back to that idea at the end so that we can talk about how to implement the practices that we'll talk about now. And you happen to pick up, of course, when you mentioned chemistry, nationwide—I don't know the exact statistics, but students often take two years of chemistry courses.

And in each course, the faculty are failing 25%, 30% of them routinely across the country. And a lot of this obviously has to do with a number of things like growth mindset and study strategies. And so these sorts of things are all wrapped up in your framework that you discuss. So let's talk about that framework now. KBCP, Knowledge, Belief, Commitment, and--

MARK MCDANIEL: Planning.

STEVEN ROBINOW: Planning. Thank you, Planning. So please, run us through it.

MARK MCDANIEL: All right. Well, I think the first component is self-evident the knowledge refers to knowledge of the effective strategies, knowledge of how to implement those strategies. That has been the focus of many learning strategy training programs. It's been almost exclusively communicating about strategies, and perhaps more recently, communicating about data that support the effectiveness of these strategies.

Really, the underlying thesis is knowledge alone is not enough. Students can know about the strategy but for various reasons not apply it in the classrooms. I think that

happens a lot. So what are some of the impediments or barriers to getting students to apply the knowledge? Well, I think one big barrier is the absence of belief that the strategy will work for them.

There's some evidence to support this, some good evidence to support this in which students in the laboratory were told about a particular useful strategy—it's kind of a challenging strategy—that shows data that the strategy works. They even can try out the strategy.

The researchers then survey where the student used the strategy, and almost all the students said, no, no, I don't think that strategy I would embrace. In probing why that was the case, students were saying, well, I don't learn like that. That may work for other people, but it doesn't work for me.

I think this is general across humans, Steve. I mean, even some instructors will say when I talk to them, well, those might be good effective instructional strategies, but not for me. It's not going to work for me, it's not my personality or doesn't fit my course, or on and on and on.

I think we all have this belief that we're unique in some way, and that what the data show for the general population may not apply to me. And I've had students say that. I mean, after just talking about a certain strategy retrieval practice, they'll say, yeah, I know that that's— I've heard about that, but that doesn't work for me, not for me.

Given that situation, it seemed to me that the strategy training has to include some demonstrations that the student engages in of the strategy, and they also in the demonstration includes a condition where they study the way they usually would study. The materials the same across both conditions of retention—everything's controlled except for the strategy they're using, and the demonstrations would instruct the student to use one strategy or the other.

So the student can clearly see at the end when they contrast their performance with an effective strategy, the one we're trying to train, in their usual strategy, they can see that the only difference was the strategy they used and it is promoting better performing. And then, Steve, a light bulb goes off. It's just fantastic in my course to hear the discussion, and we do the discussion after the demonstration.

Let's take retrieval practice, for example. That's trying to recall information as a learning device, not as an assessment device. And it is true that retrieval from the brain promotes better retention. It's not neutral. It actually changes the brain—more consolidation, more retrieval routes—and helps learning.

So it's really neat what students say after these demonstrations where they do retrieval practice on one text, on another text that we study, then a week later, I have them recall it, they will say—these are good students, these are very good students. They will say, I never thought that I would do better after retrieval practice because it felt—it was difficult, and because I couldn't recall everything, so I felt I didn't know it that well as when I got to restudy it.

But then when they recall it a week later, the retrieval practice is so much better that they say, this has been a real eye-opener for me. And so students who spent lots of time restudying now start to incorporate retrieval practice into their study routines. So that's the second step after knowledge. The student has to believe it works for them. If you don't have that, I think it's very tough to get them to sustain the use of the strategy.

After the publication of *Make It Stick*, we got an email from an AP high school instructor in economics and he said, we started to use these strategies, but—we use a lot of retrieval practice, and our pass rate on the AP exam has gone from 20% to 60%. We talked to this instructor recently, and he said one of the most fabulous moments that he had as a teacher was after having the students do lots of retrieval practice for six weeks, they took a practice AP exam and they just aced it.

And the day he shared with them the results, he said the excitement, the buy-in, the percolation going on in the classroom, the students seeing how much they learned from retrieval practice he said was a—it just gave him the shivers. It was one of his highlights as being a teacher.

And what happened there? What happened, it's obvious. The students, now they were told to use a strategy—they weren't doing it spontaneously. They were neutral about it until they saw how well they did on the exam. And then he said the class was—you couldn't believe the energy in the class and the enthusiasm and their buy-in. And that was the moment the students believed because they saw the impact.

STEVEN ROBINOW: That's fantastic.

MARK MCDANIEL: Yeah.

STEVEN ROBINOW: Two questions there.

MARK MCDANIEL: OK.

STEVEN ROBINOW: So how do you—how do students transfer that to make sure that it's disciplined and agnostic so that they carry it forward to other areas? And is it important, then, to give the students the learning experience first before you tell them

about the knowledge base? Do they need the knowledge first or do they need the aha moment before they are even ready to listen to, let me tell you what we know?

MARK MCDANIEL: Mm-hmm.

STEVEN ROBINOW: Do they need to discover it on their own, in a sense, first?

MARK MCDANIEL: That's a really good question. I don't know about that sequencing. The way the framework is laid out it's knowledge, then belief, then commitment and planning. And it's probably not—that's probably not a good way to put it. Probably those things interact with each other and one feeds back to another.

In my classes, I generally do the demonstration first, because then it gives them a personal experience that they can refer back to. That's what I do. I can't say that that's the best way to do it. Part of it is that I don't want to contaminate the demonstration. So if I've told them about retrieval practice before we do the demonstration, I don't—

They may be, even in the condition where I'm telling them to reread, they may be trying to retrieve the information covertly—that is, in their head because they know it's going to be a useful strategy. And then the demonstration would lose its effectiveness. So that's part of why I give the demonstration first, so they're a little bit naive at that point.

STEVEN ROBINOW: Yeah, there seems to be a benefit. I would think there's a benefit to them being naive and—

MARK MCDANIEL: Right.

STEVEN ROBINOW: —and having a discovery moment, that aha moment is like—

MARK MCDANIEL: Right.

STEVEN ROBINOW: And then talking about what that—what they just experienced.

MARK MCDANIEL: Mm-hmm, mm-hmm. Yes, exactly so.

STEVEN ROBINOW: Very cool. All right so let's go back to your framework. So knowledge, belief.

MARK MCDANIEL: Then the next part is commitment. I can believe, Steve, that eating a good diet—and that might include low saturated fats, not many processed carbohydrates, and so on, whatever your favorite is. I may believe that that's going to be better for my health. But that doesn't mean I'm going to do it. I've got to commit to it.

And know that in clinical psychology, clients are coming in to therapists, they display various degrees of commitment in the language they use in terms of whether they're going to adopt a particular kind of behavioral technique. It's very clear. The clients who are expressing high commitment are the ones who use their technique and they're the ones improving.

The clients who are expressing less than good commitment are the ones that generally aren't going to go home and adopt the techniques and aren't going to fare as well. So you can believe that something is going to work. But if you don't commit to doing it, it doesn't matter. It's a moot point.

I think you also have to help students commit to using the strategies. Why would that be an issue? Why would it be a barrier? Because the strategies are not familiar to the students. As a consequence of that, familiar strategies it gives—it makes them feel like they've got this life raft or this or this innertube and it keeps them afloat. It's hard to let go of that. Or your training wheels on your bicycle, it's hard to let go of those training wheels. That may be a barrier to commitment.

The other thing is the strategies are generally a little more difficult. Retrieval practice is not as comfortable as rereading. Spacing your study is clearly not as comfortable as cramming the night before the exam. Comfortable in terms of how it interferes with your schedule. So that's another barrier to commitment, is it just doesn't feel that good, it's not that much fun, maybe.

So we have to work on commitment. And there are some things you could do. You could do—you can make learning a value proposition. You can have students write a little reflection on what it would mean to do well in the class. And these can be things from—they may be first-generation students and say, well, I want to make my family proud. So it's very important for me to do well in these classes.

It may be, I really need to learn this stuff because I'm going on to medical school and I'm going to have to know this stuff. It may be, I want to enjoy learning more, and these strategies help me do that. So it could be whatever the person thinks about is valuable to them, but you have them access these things or reinforce these things. And then you have to talk about how the strategies are going to help them achieve their goal.

And then how do you get these value propositions to be most effective, there's currently research on that. Sometimes it's not necessarily writing your own, but sometimes it's looking at one of your peers. Even a value proposition that has been generated by the experimenter and said, this is one of your peers that generated this, and you comment on that and you reflect on that.

I don't know exactly the most effective way to do this, but that's been studied. But I still think you need to have this commitment. In a class, it's easy to get the commitment because part of the class requirement can be, you have to go try this strategy in another course. That's your assignment. That's part of your class grade. I believe if I hadn't done that in my class, it wouldn't have been nearly as effective, because students would have said, OK, I believe it and I know what it is. OK, good.

But now they have to go and they have to try it in a class. I think this further reinforces belief, and it also gets them to commit to use and try the strategy, so by the end of the semester, they've tried all these strategies. There are some that are going to work better for certain individuals, some maybe for other individuals, but by the end of the semester, most of them become committed to one or two of the strategies.

I know this, because just this year, I got an email from a student at two years ago and said, I have to tell you, the spacing strategy was just so effective for me and I've used it at every class. And I now am going to graduate school in theoretical math and I got into five programs. And he said, I believe it's because I've been using spacing very effectively.

For the students who give me feedback, and it's usually about 50%, that they orient toward one or two strategies that become their go-to strategy, they become committed to it, and they use it in their different classes.

STEVEN ROBINOW: Interesting. And in your class, that's one of the requirements, is they have to go out and test it. They have to experience it, test it themselves, and see how that works for them in another course. So making it discipline-agnostic right there.

MARK MCDANIEL: Yeah, that's right. If schools were to adopt a course or a module on this, I think it's possible to integrate into that the requirement that the student go try it, that stimulates commitment. Sometimes what's happening now in colleges, you've got these online strategy training courses, so you can't require anything like that. And then I think you've got to do something to develop the value proposition of the use of these strategies.

And again, there are techniques for that and they're being investigated. So we'll know more about how to do that, and in the experiments I'm doing, we're learning more about how to do that, too.

STEVEN ROBINOW: So the value propositions are used to help students prioritize their life choices, it sounds like. It's to remind them why they're there and why they're doing this and to bring it to the forefront of their thinking, maybe, to periodically remind them, oh, you're here to do this. Don't forget, so you're committed, I'm going to do this.

MARK MCDANIEL: So I'm committed. I'll refer to a really interesting study in which the researchers surveyed students about whether it was effective to space the study or mask the study. And it was set up very concretely. You have a test on Friday, it's now Monday. Would it be better to study a little bit on each of these four days prior to the test or would it be better to wait till Thursday and study all at once?

Over two-thirds of the students said it would be better if I started to space my study. So students know about that. The next step was to say to students, OK, in a second experiment, you've got an exam coming up. Now tell me how you're going to study. And most of the students said, I'm going to space my study.

After the exam, the students were queried about how they studied. I don't remember the exact number, but I think a third of the students who said they were going to space actually did space. About two-thirds said, I got busy, and so I couldn't do it, so I had to replan things. Or they didn't really plan, they just said I got busy and it slipped by the wayside.

There was another experiment done on prospective memory, which is remembering to do things in the future with students, and they came in and they told the researcher everything they intended to do the following week. And at the end of the week, the students came back in the lab and they were asked, what did you do?

Students really never forgot that they had to study, and they never forgot that they intended to do this kind of study on this day. But the one thing that got reprioritized almost universally was restudy. Other things that students follow through on. Restudying? No. Other things got in the way, or they didn't feel like it, or something came up.

So I think that you've got to develop a plan for implementing these strategies, otherwise the evidence suggests they will get turned aside by other demands on the students or other priorities. And I also think the plan—and I only say this because students have told me this, I think the plan helps hold the student accountable to their intentions.

Part of what I do in my class, they have to use the strategy we're talking about in another class, and then they have to write a plan. They have to write a plan for how they're going to use their strategy exactly from day to day to day how they're going to implement it. One of the students wrote a very detailed plan, and then there's a reflection after they try the strategy and maybe they have an exam they say or they did.

And the students have repeatedly in her reflection, I didn't completely follow my plan, but it held me accountable to what I intended to do, so I mostly did what I intended to

do with spacing. That was a positive. So when the student has to plan and write it down, then they start to feel accountable for carrying through.

And that's good, because that's the whole point of having them carry through with the intended study activities. Planning has to be part of it. I don't know how specific it has to be. I think you do have to every day think about where you're going to fit your studying into the day. Work on prospective memory suggests you have to relate that to a concrete environmental event.

So it could be, after I leave the dining hall, I'm going to sit down and I'm going to study. I'm going to do retrieval practice. Or before I go to sports practice, I'm going to spend an hour and implement the study technique. Tying a concrete event throughout the days to a particular study strategy is a pretty good way to plan.

A lot of students are taught, you've got a planner, write down specifics in the planner, but something to get the student to really concretize when they're going to implement the strategy.

STEVEN ROBINOW: I'm thinking of a number of things here. One is, of course, in the electronic age, there's tons of distractions for students. So social media is just an incessant distraction. Your phone is sending you notifications all the time and it's easy to get distracted.

So what you're proposing—and I think this is what you said earlier, is this is hard, this isn't easy. And one of the hard parts, and maybe one of the hardest parts, is really that planning and the commitment and the planning to do it. And if you plan well, like this young woman you mentioned, well, she didn't do it 100%, but it held her accountable and she returned to it and she didn't give it up totally and it had some impact.

MARK MCDANIEL: Yeah. I think it's like trying to start an exercise routine. A lot of people have these good intentions, and they might go once or twice, and then it drops out. They say, I got too busy, it was hard to fit it in. The only way it works is to say I'm planning today to go do my swim, and in fact, I am after the podcast. I have a plan to go do my swim and I'm not going to—I'm going to hold to that plan because it's in my calendar, it's one of the things, it's one of the events of the day.

If I just said, well, I got to get over to the pool and swim, it's never going to happen, Steve. But when I have a plan and when I write it in the calendar, then I hold myself to it. And then it becomes something that if you miss it, you feel uncomfortable, you feel something's wrong.

So I think for almost anything we do that maybe is a little bit challenging, a little bit difficult, I think you need to make a plan, otherwise human nature says you're going to find a reason not to do it.

STEVEN ROBINOW: Now you and I have had more time to learn this, and the students have not had quite that much experience as we have. And that's the challenge, is there's lots of time, but never enough. So you also lay out in your paper an example of how to do this. Do you want to describe that briefly?

MARK MCDANIEL: An example may be how to construct a course?

STEVEN ROBINOW: Yes.

MARK MCDANIEL: I think one needs to develop a demonstration for each learning strategy and have each student experience for themselves the benefits of using the strategy. I generally would ask students to predict which strategy is going to work better, the one they used or the one that was instructed.

Often what happens is, similar to the literature, the student doesn't think the effective strategy is going to work that well. So it's very useful for them to understand that their metacognition—that is, their thoughts about their own learning and cognition are often not accurate and often in contrast to what's most effective.

And I think that's really useful for them because then later when they try the strategy on their own, they'll understand that they may have those metacognitions. They're not necessarily that accurate and students shouldn't depend on those so much.

So I can give you another example. One of the strategies we talk about are mnemonic strategies. A lot of times educators these days say, oh, why would we use mnemonics? That's just memorizing information. Well, I've got news for lots of educators. A lot of what we're requiring students to learn require them to learn arbitrary association. These are things you can't generate understanding for. These are things you can't build mental models. For example, the name of a scientist and his or her contribution to the field, students are required to learn that in some classes.

I think it's backwards to say we're not going to encourage students to use mnemonics because that's just memorization. That's what's required for a lot of things. So anyway, I do that. I teach a mnemonic strategy it involves using imagery. And learning definitions for unfamiliar vocabulary. So students try to learn 30 of these on their own, and then I give them another 30, and they use an imaginal technique.

And again, the reflections are very neat. A student said, well, I don't think that imagery strategy is going to work at all. I felt like as soon as I made the image, it disappeared.

And when I restudied, I just really concentrated on those definitions and I knew I'd learn a lot from that. In fact, the opposite occurred, and the student said, I was amazed how those images just popped to mind. When I got the keyword, they popped to mind, and then I was able to give the definition.

So again, the experience of the student, experiencing how effective it is even though at the time they think it's not going to work at all is really important. And so for each strategy, I devise a demonstration. So I think that's really important. And as I said before, I do that first so that they're naive to the strategy; otherwise the demonstration is going to be compromised.

But then we talk about the strategy. We talk about the theory underlying the strategy—not too much, a little bit. And then we talk about data that shows it's not just this demonstration of class, but many, many studies show that this is an effective strategy for this content, for these age groups, and so on.

So we go over some of the science behind the strategy, we don't overdo it. So tell me a feedback. I don't need to know that much science about the strategy. So that could be cut—a lot of that could be cut and made into a shorter course. And then they have to use—the assignment is to use the strategy so they're committed to it at least for one assignment. And they have to plan, they have to develop a plan and they have to turn it in, so the learning plan.

They try the strategy out, we discuss it in class. Sometimes it doesn't work, but it's not for reasons that the strategy is ineffective, it's sometimes students have not identified the right material to study. So we talk about that. We say, well, the strategy was fine. You just need a tune-up figuring out what's going to be on the exam.

And then they write a reflection. The reflection is really generated from what we talk about in class, so it's not onerous, you wouldn't have to do that. I talked to students about how the strategy might be used in different content areas. So there's the knowledge part. They get a demonstration so that they believe it works for them.

They commit to it—they have to commit to it. They try it. Everybody tries it in at least one other class. Many students try it in two or three other classes. And then we reflect on it and we move on to the next strategy. So that's basically how a course would be structured around those four components.

STEVEN ROBINOW: Right, interesting. So as you were talking and thinking about evidence, here's what works versus belief, we all know how strong belief is and how important that really is. And in terms of integrating it, and like you said earlier, we're all unique in our own special ways, but we're all the same at the same time.

MARK MCDANIEL: Right.

STEVEN ROBINOW: So as a population, we know that, and as scientists, that's how we—certainly as somebody who's studying humans, it's a numbers game and we're all the same. But getting each individual to accept it, in this case, I can understand why a student would say, I don't really need the data, because they need to experience it themselves, they need to believe it and take it in. A little bit of evidence.

OK, so this is based on evidence. Well, that's nice. Certainly for us as scientists, I think it's nice that people appreciate that science—well, we already knew this. We've studied this, we could have told you this, but in order for you to adopt it, we also know that you really have to experience it. That it's not about me telling you, we tell people a lot of things and they don't believe it at the end of it. We tell people all kinds of things.

MARK MCDANIEL: Right.

STEVEN ROBINOW: You don't just open the lid and pour it in. It's experiential, students have to construct their own knowledge and their own beliefs.

MARK MCDANIEL: Exactly right. So I want to be very clear that my course was a semester-long course, and it was designed to be, let's say, 50% the science of learning and 50% students learning about and using these strategies. So I firmly believe you could cut out half of what I did in terms of presenting the evidence and the theory.

I agree with you, there's no need for that. If you wanted to just have a streamlined strategy-training program, it wouldn't have to be a full semester, that's for sure. I think if it were going to be and you didn't want to do all the science of learning, I think that's fine. You could just you can have students try these strategies more than once in different courses. So you could give them more experience and more variability in the use of the strategy.

So what do I mean by that? A concrete example. Retrieval practices is this general idea about you've got to retrieve from memory. Retrieving from memory is going to produce more potent memories, more durable memories, and maybe better transfer. Well, that's a general technique that can be instantiated in lots of different ways.

So one way that students already use it is in using flashcards. And if you've got an associative task, learning task like remembering the contributions of different scientists in a particular discipline, you've got to associate the scientist with the contribution, that's perfect for flashcards. Because with flashcards, you're given the term or the name and you've got to retrieve the contribution, and then you turn it over and check it, that's just perfect, because that's exactly how the student's being tested.

Free recall, that is, retrieving all the names and what they did, well, you'll learn more, but you don't have to learn the name, so it's a wasted effort. On the other hand, I had students say courses where they had to write essays, maybe philosophy courses, and retrieval practice—free recall was better, because they have to, without any cues, they have to generate the content they're going to write the essay exam on.

And so being able to retrieve the different ideas about, I don't know, epistemology, whatever it is, and being able to retrieve different arguments about it, that's very important. So they wouldn't use flashcards, necessarily. They would maybe read an article and then try to retrieve as much as they can and then review to see what they still need to pick up.

In some cases, we found in middle school, giving retrieval practice as recognition tests—that is, multiple-choice tests, taking practice multiple-choice tests is perfectly fine for those students because those are the kind of tests they're going to have, and that kind of retrieval practice is just very suitable. That's what I mean by giving students more experience with the strategy.

If I had a whole semester and I wasn't spending half on the evidence and the theory, I'd give students more experience in retrieval practice and talk to them about how different retrieval-practice techniques are going to be better suited for different kinds of learning requirements. So that's an example.

STEVEN ROBINOW: And students can learn from each other as well, and I'm sure they do in your classes. They report out, oh, I use this in a chemistry class, I use this in an English class, I use this in a history class. Well, they can't experience all that all at once. But learning from their peers and hearing it from them also must be very powerful, a very powerful moment for students in your course.

MARK MCDANIEL: I think you're exactly right, Steve. I think it's even more important in the middle school, early high school years. I'm working with a high school that's trying to develop some learning-strategy training. I actually was in some classes—I actually visited some classes, interacted with the students, asked them, why are they studying the way they are? And many of them say, well that's the way my friends study.

We get together and I—and we talk about how we're going to study for this, and we all study for it the same way. So I think that helping students to understand what effective strategies are, getting them to believe in it, and then they reinforce each other. They're all copying each other in the strategies that you use, so you want them to copy each other on these good strategies.

So I think what you said is especially important in the early high school years, middle school years where what your peers are doing is very important to you, and that extends to study strategies.

STEVEN ROBINOW: Interesting.

MARK MCDANIEL: Yeah.

STEVEN ROBINOW: So that's great to bring it into high schools, and of course, if students come to college trained in this, then we don't have to train them in that.

MARK MCDANIEL: Exactly.

STEVEN ROBINOW: But that isn't the way things are today.

MARK MCDANIEL: No, it's not the way things are today.

STEVEN ROBINOW: Universities are expending effort trying to improve student success. And we know that student success in the first year or two is critical for retaining the diverse students that come in.

MARK MCDANIEL: Absolutely.

STEVEN ROBINOW: The diversity of the students that come in is lost in the first year or two.

MARK MCDANIEL: Yeah, that's right.

STEVEN ROBINOW: There's a disproportionate loss of the diversity. It's great that people are paying attention. I guess there's a couple of things. One, we need more research that you're proposing. So you've proposed a framework, now we need demonstration that this is effective or this or other frameworks.

And then we need them implemented, and we can't wait. We can't wait a generation or a half a generation for kids to come up from fourth or fifth or seventh grade and through because we lose all the students that we have today. So it sounds like what we need is an intervention on day one, if not before, the summer before something, a boot camp to really give students this training in this experience so that they can believe that there are better learning strategies out there and so that they will implement them.

MARK MCDANIEL: I agree, Steve. I agree completely. And I'd like to even expand that a little bit.

STEVEN ROBINOW: Please.

MARK MCDANIEL: I'm getting inquiries and I've given talks at professional schools. So this isn't just limited to university students. This is very important to professional schools, too, where the amount of material is so heavy and it's at such a fast pace that students who aren't effective learning learners quickly fall behind and then it's very tough to catch up.

This idea of a boot camp is something that I've talked with the Purdue Vet School. We were talking about a little three-to-four-day boot camp to help students understand and believe in these effective strategies. It's not just universities, it's even higher up, it's needed for some students. And your idea of a boot camp, I think, is exactly right.

STEVEN ROBINOW: So how long does an event need to be? How much exposure and reinoculation or repractice do students need? Because, I mean, a week isn't enough. I mean, students need to do it. They really need to integrate this, this needs to become part of their soul. It needs to be pounded in deep.

MARK MCDANIEL: I know. So I think part of it has to be also instructors need to be aware of what these strategies are and need to—I don't know if reinforcement is the right term, but it's to encourage it throughout the semester, to encourage it and support students in their attempts to do this. I think that's right. I think you have to have the culture of the school or the class or so on be oriented around that. I think you do.

STEVEN ROBINOW: And that may sound impossible, but as we're talking about it, of course, the most important time is the first semester or the first quarter.

MARK MCDANIEL: Mm-hmm

STEVEN ROBINOW: Where there are certain instructors that are regularly teaching those courses and you might have a large-enrollment biology course or a large-enrollment history course. With the right instructors, you could do what you mentioned teachers do in primary and secondary school, which is cue students periodically just to percolate it back up into their head, right?

MARK MCDANIEL: I agree completely.

STEVEN ROBINOW: It's fascinating.

MARK MCDANIEL: I think to be extremely effective, I think that's the kind of thing that you'd want to see, I agree.

STEVEN ROBINOW: OK. So we've got to get this out to universities and they need to start to understand. So tell me what, then, is your next plan? Hopefully you're going to follow this paper up, because this paper lays out the framework, but now we need data.

MARK MCDANIEL: That's right, you're absolutely right. I don't really want to be pushing this hard until I have the data. I mean, I believe, but I want to have the data before I'm going to talk to people about the expense and the redesign to include this. So what I'm doing is trying to get grant money from the Department of Education, their research funding arm as the Institute of Education Science for a four-year project in a middle school where we would experimentally look at the value of adding each component successively.

STEVEN ROBINOW: Mm-hmm.

MARK MCDANIEL: So we would go with a bare-bones training where the students are just given the knowledge and investigate whether they've adopted these strategies, whether they can even use a strategy in a learning task, a science learning task. And then in another group, add the belief component and see what kind of increment we can get there. And then add the commitment component, then add the planning component.

If we get this grant money, at the end of four years, we'll know a lot more about the benefit of each component. Then if you use the full KBCP whether you're getting good self-regulated use by students—I mean, that's one question, of course. You want to get that. If you're not getting that, then what's needed? Is it more training and the commitment? Is it more—who knows?

Or what we could find is, after they have the belief and they're committed to it, maybe planning, you don't need to spend some time on that. We'll know about the necessity and the sufficiency of each component. That's the idea to gather those data.

And then another project in collaboration with University of Syracuse Learning and Teaching Center, the director there is very committed. She already has a peer learning strategy program in their calculus course. The calculus instructors really embrace this, and many of the students go through that. We got a grant into NSF, National Science Foundation, trying to get money to objectively evaluate this training versus control that doesn't get this training.

So there are plans to evaluate this both in middle school and into college. And we'll learn something from that and we'll see how effective it is, and we'll learn what things maybe are needed to expand it and what things may be aren't so necessary. And then

as we learn more, obviously I will be communicating our results through podcasts, research papers, things like that. So that's the next four years.

STEVEN ROBINOW: That's great. And there may be listeners here who are education researchers who may want to do something smaller-scale in their classrooms related to this framework, and I'm sure they should contact you.

MARK MCDANIEL: They should. Maybe you can end on this note. We do have a small program in the ninth grade area algebra class. It's small-scale. We don't have support for it, so the teachers are working very closely with us to do a little bit of strategy training. And one of the things we're training is how to generate understanding. Generating understanding by explaining why certain principles are as they are and explaining how these principles work together in terms of attacking certain kinds of problems.

Generate understanding produces memory. Memory's a byproduct of that. So we teach that instead of memorizing. And we have a demonstration for this. Really, a powerful demonstration. It works with seventh graders all the way up to college students. And we didn't do much training. It was just an hour and a half, and it was just our first attempt. It was just two sessions.

And the next semester, the instructor contacted me and said, I've got a story to tell you. Had a student who was floundering, getting a D, and this semester, the student's a B student. And I asked the student, what's the difference? Student said, well, it was that demonstration that we did in class on generating explanations. He named the demonstration, he named my assistant who did it, and he said, I now get it. I now, when I'm hearing explanations in class, I'm really listening. I'm really attempting to relate it to what I already know. Perfect.

STEVEN ROBINOW: Wow.

MARK MCDANIEL: This student was turned around just by the demonstration, Steve. Just by the demonstration.

STEVEN ROBINOW: That's fantastic.

MARK MCDANIEL: It's what you were just talking about. Students who are floundering who may drop out of the system, who may not think they're good in science, just some components of the [? sort of ?] strategy training may flip the switch.

STEVEN ROBINOW: Yep.

MARK MCDANIEL: And get them into the swing of things. Get them into learning the material and becoming more happy, engaged students. So I know this is just one student, and it was just a small class of 10, but this is the kind of thing we're shooting for. And it can happen.

STEVEN ROBINOW: That's fantastic because there are all these students that are struggling. The A and B students, they'll be OK anyway no matter what you do. They'll be OK. But these students who are—yeah, you have to go.

MARK MCDANIEL: I have to go.

STEVEN ROBINOW: OK. OK. Well—OK. Well, so we're going to have to talk again, because I have other questions to ask, but we didn't get to them today. I want to thank you so much for your time. You gotta go for that swim. That's great. It's on the schedule. I know, I know, you're not seeing him shake his head and give me thumbs up there, but he is.

So this has been a fascinating discussion. I really look forward to having you back and hear about the progress, and then maybe hear about a few personal stories from you about your teaching and your experiences in life. Thank you again, Mark, so much for your time. This has really been a blast.

MARK MCDANIEL: OK, Steve. I'll be happy to come back any time.

STEVEN ROBINOW: Great. Thank you so much.

MARK MCDANIEL: OK.

STEVEN ROBINOW: All right.

MARK MCDANIEL: OK.

STEVEN ROBINOW: Bye-bye.

MARK MCDANIEL: Bye-bye.

STEVEN ROBINOW: For more information about Mark McDaniel, his research, and his recommended reading list, please visit our website, teachingforstudentsuccess.org. Thank you for spending time with us today. I hope you found this discussion interesting and helpful.

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