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## Factors which Influence Motor Learning - Merging Psychological and Movement Science Evidence into Practice

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- [Jessica] Our presenter today is Jill Seale. Jill has been a licensed physical therapist for 22 years. She received board certification in the area of Neurologic Physical Therapy Residency Program, guest lectures at the Baylor College of Medicine Physical Therapy, from the American Physical Therapy Board of Clinical Specialties in 2004, and re-certification in 2014. She has practiced almost exclusively in the field of brain injury and stroke rehabilitation. She has a variety of teaching experiences in physical therapy academia, as well as the health care community at large. She is currently faculty in the DPT program at South College. She has served as core faculty in a neurological master of orthotics and prosthetics program, and teaches in several online and onsite continuing education programs. She's taught and presented in the areas of neurological pathology, rehabilitation, GATE, orthotics, mentoring and research, and is currently involved in clinical research in stroke rehabilitation, orthotic management, and GATE analysis rehabilitation. Thank you so much for returning to [www.physicaltherapy.com](http://www.physicaltherapy.com), Jill. At this time I'm turning the mic over to you.

- [Jill] Okay, thank you so much and welcome, everyone. Thank you all for joining us this afternoon or this morning for those of you who are on the West coast. Glad to be back with you guys to continue our discussion. For those of you who were able to join us last week for our discussion on the fundamental principals of motor learning, we're continuing our discussion into more, what I would consider more contemporary topics of motor learning, really focusing in on looking at the psychological and cognitive factors that enhance motor learning in our patients. And so, that's what we will jump right into. I do need to read the learning outcomes to you. After this course, participants will be able to define the basic motor learning principles of practice and feedback, identify at least two psychological or cognitive variables that impact motor learning, including autonomy support, attentional focus, and expectancies. Identify at least four principles necessary for effective practice in persons with neurological injury, with a focus on the perspectives of cognitive, psychological, and social sciences.

Identify at least three evidence-based models of motor learning, including the psychological and cognitive factors, and list at least five treatment strategies that incorporate psychological and cognitive variables into practice conditions in order to enhance motor learning and outcomes. So those are the objectives for today. And as you can see, we have a lot of material to cover. So let's jump in. I'm assuming that maybe not all of you guys joined in last week, or even if you did, maybe you've already started piling stuff on that material, and so I wanna take just a moment, a brief moment to review what I consider to be sort of, those fundamental principals of motor learning. And this is like the elevator version of two hours worth of talking. When we think about motor learning, what it really means is, how am I acquiring or modifying movement? So, it's the acquisition or the modification of movement. And so when we think about our patients who've had some type of neurological injury, we're really talking about how they reacquire movement skills that have been lost due to some type of injury to the system.

And so what we talked about last week is that this is a process, that motor learning are these processes that are associated with practice or experience, in other words, we have to have some opportunity to experience the movement, to practice the movement, meaning it's something that happens over time, over repetitions, and it should lead to a relatively permanent change in skill. And so we talked about last week these key concepts. A, it's a process, results experience or practice, can't be directly measured, but it's inferred when behavioral things improve, right? So, we look at retention tests. We don't assess an outcome measure in the middle of our practice, we get some delay in time after practice, and then reassess the skill to see if they've actually retained it. Because we're looking for that permanent change in behavior. And the last statement is one that's been around for a long time, but I think really nicely sums up these concepts. Carr and Shepherd talked about it in the '80s, that learning can only be assumed to have taken place when the patient can perform the task effectively, without thinking about it in a variety of circumstances and contexts. And so

I'd encourage you to pause right here even, and think about, okay, at the end of the day, at the end of my treatment, the litmus test that I should be looking at is: Can my patients perform whatever it is that we're working on, can they perform effectively? Can they perform it without thinking? And can they perform it in a variety of circumstances and contexts? I would offer up, I guess, my opinion.

My perception around this is, for many of us in rehab, we may get our patients to the point where they can perform something effectively, but oftentimes we don't get them to the point where they can perform it effectively without thinking about it, and I know this because my patients oftentimes can't dual task. If my patient can't dual task, if they can't do a motor task while they're doing some other task on top of that, cognitive or another motor task, then that means that they haven't learned to be able to do it without thinking about it. I think we don't oftentimes always get them to the 'without thinking about it' part. And I think we oftentimes don't get them to the being able to do it in a variety of circumstances and contexts.

And many of us would say, well, that's because where I work and the setting at work; I'm really limited to only being able to do rehab in an indoor setting or in a setting that's very clinical and not very home-like or work-like. Certainly there's limitations on us in terms of how much we can work on that circumstances and context, but just keeping in mind that learning means the patient can do it not only just effectively, but without thinking about it in a variety of circumstances and contexts. Oftentimes we assess our patients, we grade our patients in the clinic and we say, this person has reached a modified independent level, or a supervision level or whatever for let's say, some walking task that they're doing with us. But when my patient goes to Target with their family or is walking, maybe, in the hallway, downstairs in the lobby where it's more busy, their walking degrades; they require mid-assist, maybe, to keep them from falling. Maybe they have some missteps and near-falls in those situations. That tells us that our patient has not truly learned this walking task effectively, without thinking

about it in a variety of circumstances and contexts. I encourage you to keep that in mind as our measuring stick for assessing if our patients are truly and fully learning the motor skills that we're trying to help them reacquire. We talked about last week that motor learning emerges from the mixing and melding of these three circles. The person or the organism, the environment, and the task itself. So, a movement emerges based on constraints that can come from any of those three systems. The patient, obviously, brings various constraints like weakness, loss of range of motion, cognitive impairments, sensory impairment, the list could go on and on. The environment can impose some constraints or actually improve our motor performance based on the busyness or lack of busyness of the environment, the distractions or lack of distractions. The type of services that we're walking on, the visual things that we're having to sort through in order to do our ADL tasks that we might be thinking about. And certainly then, in terms of the task, it has a variety of ways that it can make movement better or more challenging. I often say, we should have this way to grade our tasks on degree of difficulty, like skaters and divers. They rate a particular routine by its degree of difficulty.

And so, we as therapists choose tasks, and we set up a task in a way that imposes a certain degree of difficulty. Sometimes that degree of difficulty is too great for the patient to accomplish, given what they're bringing to the table; given the constraints on their system. And so we can modify the task, creating a slightly easier or slightly more challenging task. We can modify the organism by maybe increasing activation or giving them more range, or compensating for lost range, or any number of things that we do. All the things that we do to treat impairments. We can certainly modify the environment by making it more simple or making it more complex, creating a dual task in our environment, as opposed to a single task. Those are all things that we might do to help motor learning occur. Maybe sometimes making the movement a little bit more simple to accomplish and sometimes making the movement a little more challenging to accomplish depending all on how the patient is doing in that moment. We talked about

last week, and we talk about often, creating this situation of balance between challenge and success with our patients. We wanna choose things that are sufficiently difficult and challenging, to promote motor learning and thereby promoting neural plasticity. But we also wanna make sure that we're building in some successes so we keep motivation high. And we're gonna spend a lot of time talking about motivation today, and get more into the details there. To kinda summarize, we talked about last week those, what I termed 'Familiar' Factors of Motor Learning and I say that because, for those of us who went to school as long ago as I, or even went to school and graduated even a decade or more ago, I think some of the things that we talked about today are going to be new, not familiar factors.

So, what we talked about last week being more of those familiar factors. Last week we talked about practice, and all the various practice levels and practice components. With practice oftentimes being identified as the most important factor in retraining skills, being that amount of practice. But again, we said it's not just about the amount of practice, it's really about how we construct the practice and what exactly it is that we're practicing. Making sure that we're practicing things, again, with that sufficient complexity, difficulty, intensity that we talked about last week. And then, the other familiar factor that we covered in detail was about feedback. We talked about how we utilize two mechanism: Intrinsic and extrinsic.

And that our patients become highly dependent, oftentimes, on the extrinsic feedback that we so readily provide. And we all identified, I think, probably most everybody in the class, at least in their mind raised their hand, with a 'I need to be better' at providing a little less feedback because we know that too much feedback can be deterring to motor learning. And we'll talk more about that today, and when that principal doesn't quite apply. But in general, too much extrinsic feedback, not being a good thing. And so, those are kinda some of the things that we talked about last week, in a nutshell. And then the last thing that I wanted to mention, because it'll come up again today, is

this idea of the guidance hypothesis. We mentioned this last week. This essentially is a hypothesis that's been around since the '80s and '90s that talked about, when I provide feedback to a patient, I can certainly help them correct the movement and improve their performance while we're practicing. But that frequent feedback can have a negative effect, or a negative impact on their ability to learn and actually retain. And that when we provide too much augmented feedback, some augmented feedback can be beneficial, but when it becomes relied upon by the patient, that's detrimental; oftentimes we do reach a point where the patient's relying on our feedback rather than developing their own intrinsic feedback, and paying attention to their intrinsic feedback. The intrinsic information is always there, but if they're listening to us, or feeling our manual cues, then they're not really tuning in to their intrinsic system, their internal feedback system that they have.

And so this guidance hypothesis has been widely accepted. I provided you a slide here that talks about, this looked at normals, and again, looked at it in patients with stroke. And those people who had high frequency and a lot of physical guidance had the poorest retention. And anything that included high frequency resulted in less accuracy in transfer. Meaning, again, transfer being that trickle-down effect of where I'm learning one particular motor skill and I'm also gonna improve in skills that are similar and related to that without practicing them because I've learned this one skill, it's gonna trickle down and improve everything below it. That doesn't happen as well, according to these studies in patients who get too much, or a high frequency of feedback, and again, looked at in normals and found the same results in patients with stroke. And this was data that was done quite a while back. And the reason why it's important is because we are gonna challenge that hypothesis in our discussion today. And we're gonna talk about what conditions challenge that. Again, this is to provide for those of you who maybe weren't here, or just a refresher. Here's the practice conditions that we talked about. We talked about all of these last week. Massed versus distributed, constant and variable, random and blocked, whole and part. With all of those saying

that the way that we construct our practice can facilitate motor learning or maybe be detrimental to motor learning. We talked about the need to get as much variability of practice as possible. We talked about how some patients don't tolerate variability of practice, and those are patients who have significant cognitive impairment. But for otherwise, all the rest of our patients, we really wanna be pushing that variability. We may start off with something more masked and constant to help them learn the task. But we wanna progress that variability and introduce some randomness into their practice. Because it creates that situation of contextual interference. It adds a degree of challenge, which we know is helpful for learning.

We talked about how whole versus part, we can certainly break some tasks down into parts, things that break apart easily. But we wanna progress to whole practice as soon as possible and if we don't need to break things into its parts, don't do it, just practice the whole. We talked about how, the goal is to have transfer. If we're gonna be the most efficient therapist, it means that the things that we're doing are so good that then, the skills that are similar to the ones that we're focusing on are gonna improve as well. We're bringing everything up together. That happens the best when we practice intensely. Whatever it is that we practice, practice with a really high intensity and you'll have more of that transfer to similar and maybe even not-so-similar skills. We talked about the importance of mental practice.

The mental rehearsal of a motor skill that when you mentally rehearse, you get activation in the same parts of your nervous system as you get activation in when you physically do the skill. And so, a way to get more practice into practice. And we talked about guidance versus discovery learning. We, especially as neuro-therapists tend to do a lot of guidance; we like to put our hands on the patient and physically guide them. And we talked about how that is probably not as beneficial at helping the patient truly learn, as allowing them some trial and error, some what we term, discovery learning. And one thing that we didn't really talk about, but I wanna mention today as we get

started, a couple of concepts: This idea that complex skill versus simple skill learning. We talked about last week how you needed a skill task. You couldn't just practice something that you could easily accomplish, that it needed to be something that had some degree of difficulty that you couldn't accomplish easily. Giving the idea that things that are too simple a skill are probably not beneficial. But we do wanna think about our activity that we're having the patient to do, and rate it on its degree of complexity. Something that's too simple has low processing demands. In that situation you would benefit from giving them some practice that increases the load, or increases the challenge. However, if it's a situation that has an extremely high/low condition, something that's extremely complex, or physically difficult, that situation may benefit from reducing the load to a more manageable level. Giving us this idea that we do wanna achieve a balance. I think at one point in my career, early on, I just thought everything needed to be made as hard as possible for my patient.

Just make it as difficult, I thrived on creating crazy difficult things for my patient to do. And I missed this concept right here of achieving that teeter-totter balance between something that's complex enough to keep the patient engaged, and stressing the system, versus something that's so complex that I really need to take it down a notch so that they can achieve success at that. When you give them a very complex skill, more feedback may be necessary. When you give them something that's more on the simple end, I really wanna attend to the fact that I'm giving them lots less feedback. That I'm not really giving them much feedback, whether it's manual feedback or verbal feedback or whatever it is. But regardless, I wanna always be helping them shift, especially in that complex situation, to more intrinsic kinds of feedback. Away from my external feedback, and more into intrinsic. One of the things that I've listed here that may influence, mainly learning of complex skills is intentional focus, which we're gonna talk about today. And observation learning, which we'll talk about today, but we also talked a little bit about last week, and this is putting the learning into the learner's responsibility. So that they're not developing that reliance or dependency on me for my,

for my feedback that I'm giving them. How do we do this? How do we balance between the complex and simple skill? Again, we think right back to this schematic, and we manipulate these factors to achieve that balance. Maybe I help the patient. Maybe they have some restraint of maybe a loss of range of motion, and maybe I give that back to them with mobilization or stretching, or whatever. And maybe I compensate for it. And that creates this balance between something that's simple and something that's complex. But remember, we just wanna think about manipulating one of these three factors, or more than one if the case requires. And then the other last topic before we jump into some of these newer factors, is this idea of physical assistance and physical guidance, 'cause I think this goes right along with the things that we've started talking about now, and some things that we talked about last week. Oftentimes people use these terms interchangeably.

Physical guidance and physical assistance, but if you look at the literature, they talk about physical guidance being where I'm more, moving the patient, guiding the patient, I'm more in control of whatever it is that we're doing. And when I provided this physical guidance, it's something that the participant may become dependent upon. And they may not have very much, they may not have very effective learning. And I know this because once I take my guidance away, they aren't able to do the movement or the skill or the task. And we see that all the time.

Versus physical assistance is that I'm providing support for learning, that's probably the key three words there, four words: I'm providing support for learning and so therefore this is gonna facilitate achievement of the movement goal. The next bullet point I really love. Provide more freedom for exploratory activities. I'm providing whatever assistance they need to be a little bit more risky, almost. To make a little bit bigger movement. To explore movement a little bit more because they feel like they have the assistance that's gonna keep them safe, and therefore they're a little bit more willing to explore movement a little bit bigger, a little bit better, a little bit more. And

again, I'm trying to reduce the demands to something that's manageable. And it's thought that this increases the efficiency learning and certainly we can think about this in the ways that we provide physical assistance. We can think about this in terms of some interventions. You might think about, maybe, body weights for treadmill training, it's kinda what that does. Oftentimes people think it's some magic about the amount of body weight. I don't know, I'm not such a believer in that, as I believe that we're creating a situation that's more manageable. We're making walking more manageable for the patient, therefore they're much more willing, and it's a safe situation. They're much more willing to explore and move more freely, move more aggressively. I feel like, if I could have one thing in a clinic where I was gonna work, it would be an overhead harness system. I don't need the body-weight support, I just need the harness system so I can put my patients in that and they can feel a little bit more confidence, really explore movement, because we know that that seems to then, when they take more chances, they explore more.

That tends to improve the learning. I'll give you an example here on this next slide, if you're kind of wondering what I mean by all that. One research study in normal subject in sports, in the sports world that demonstrates this has to do with skiing. And so they looked at when you take a complex task like skiing, if you compare two groups of subjects that you train on one of those, those glider kind of pieces of equipment where you're standing on, and you're going back and forth with your feet, just like you are when you're skiing, that's how you train skiing. When you do that, if you have one group that you don't give poles and you have another group that you give ski poles to, and then you test them, all in the same condition, choose one or the other, the group that have the ski poles in their practice, seems to learn the skill of skiing better and the thought is that giving them those poles gives them a little bit of assistance. Assist doesn't have to be me physically assisting them. It gives them a little bit of assistance, so they actually, and if you look at the movement that they're actually doing on that trainer machine, they're doing bigger movements. They're moving further to each side

than the group that doesn't have the poles tends to make small, amplitude movements. And so you think about how do I, what does this translate to me as a therapist? I wanna think about what I'm providing the patient, whether it's my physical assist, whether it's the assistive device I'm giving them, whether it's how the environment and how safe or unsafe the environment is, that it's promoting them moving more and feeling a little bit more free to move. A little bit more willing to make a bigger amplitude movement. To do something at a faster pace. Again, you can think about that a number of different ways. But so that they're exploring movement in a bigger way, I guess, would be the final thing to say about that.

And again, I always go back to thinking about, man, what would I like most? I'd like a harness system, something that's gonna give the patient a little bit of security so that we can be a little bit more aggressive in our movements. If we move now to, we've already inched into this, but if we talk about the things we're gonna be moving towards, and talking about today, it's really going beyond just the acquisition of movement or the movement pattern. We're gonna be talking about the cognitive processes, the affective reactions, and the attentional focus and how those all work together to meet task demands and help with motor learning.

Again, I've turned this, the less familiar components. It's these components that really impact the cognitive and psychological parts of our learners. If we think about this, I have divided this into motivation and attentional effects on performance and on learning, because what we're gonna be talking about now, all of these factors tend to improve performance and learning. Remember, we talked about there are things that we do that can certainly improve performance, like how I handled the patient, how I guide the patient, but those don't always translate into improvements in retention; here we're talking about things that are gonna improve both performance and learning in the patient. We can subdivide them into motivation and attention. We can further subdivide motivation then into enhanced expectancies and autonomy. We're gonna spend some

time now talking about each of these, presenting some of the evidence that's available about this. And we'll start out talking about the motivational components. I think we've always known that motivation affects how are patients' outcomes. Our patients who are more highly motivated tend to do better, but I think I've always just thought of that in very global terms like, well, they're more motivated so they work harder. I didn't really equate motivation to motor learning. And what we know from literature that's come out in the last decade or maybe a little bit longer than a decade, is that there's a huge link between motivation, a very direct link between motivation and motor learning. And so, we can do things as therapists that are going to impact this and help to drive improved motor learning. The augmented feedback that we're providing needs to be information, but it also needs to be motivational, and we're gonna talk about what that looks like. We know that there is this motivational function of feedback that motivational properties directly impact the affect of learning.

And I just love this statement: Thought to energize task interest and encourage continued effort, persistence and attention to goal accomplishment through evidence of performance progress. So, if I'm really providing motivational feedback, it should energize task interest. Encourage continued effort, persistence, and attention. We so need that in our patients towards goal accomplishment. And then that last statement is really important. Through evidence of performance progress. All of this is underlined and underscored by the need for evidence of performance progress. Do you provide your patient, your client, the person that you're working with? And again, this doesn't apply to folks with just neurological injuries, this applies across the board: sports, orthopedics, pediatrics, geriatrics, whatever we might be thinking about. Do you provide evidence of performance progress? Simple little thing to do in most cases, to be able to provide some evidence of performance progress but when we do that, we keep them energized and interested in what we're doing, help them have some continued persistence towards the goal and maintain focus on the goal. We talked about the two factors here, motivational factors being autonomy support and

expectancies. Autonomy is a word that most people understand, but oftentimes don't necessarily think about how to incorporate this into therapy. Autonomy means that I'm providing some type of choice. I'm providing some degree of control. This has been shown over and over to increase motivation, performance, and learning. I think even as a young therapist, I realized, especially working right out of PT school, I worked in an intensive in-patient rehab for patients with really catastrophic neurological injuries, spinal cord injury, brain injury, stroke, and others, and I definitely knew that when I helped, when I gave my patient a little bit of choice, a little bit of control, because most of them were lacking any control over their situation.

Think about your patients. Even your patients who come in with a muscular-skeletal injury, they feel in many ways a loss of control. A loss of the ability to be in control of their body, and so, to some degree that's the case with all our patients. And I think I tuned in right away that when I can give a little bit of autonomy, I can give a little of choice, or whatever, that patients tend to like me better. They seem to be a little bit happier. I just took that as a, well, this makes them feel good. This just makes everything better. What we know from the evidence, it's not just that it improves their motivation, but that in turn improves, literally improves their performance and their retention of what you're teaching them.

Retention of what they're actually learning. And what drives this seems to be self efficacy and we're gonna spend some time talking about that in a little bit great detail. The second factor here in the motivational category is enhanced expectancies. And this is one that sometimes people are even less familiar with, or have less of an idea about what this means, but this just means that I am enhancing the positive aspects, kind of, of everything. I'm focusing more on positive feedback. I am creating a situation that says, I fully believe, I expect that you'll be able to accomplish whatever it is that we're working on. Or, I expect that you're gonna be able to do this faster than the last time we tested you. And also helping the patients create that for themselves. How

much faster can you do this task on our next attempt? Creating a situation that says to patient: I expect that you're gonna be able to do it faster. Obviously I wouldn't of asked you this if I didn't expect you could. And now I want you to tell me exactly how much faster can you do this. And the literature shows, over and over, that these two, I don't wanna say they're simple, because that makes them seem not important, but these two easy-to-accomplish things has a huge positive effect on self efficacy, motivation, which in turn has a positive effect on performance and actual motor learning. Let's dive into those a little bit. I get revved up talking about this. I geek out and go total nerd on ya. Let's talk about enhanced expectancies first. There's a lot of work out there. And what you're gonna start seeing if you look at these citations that I've provided you here, you're gonna see some authors that get mentioned over and over and over. Gabriella Wulf and Rebecca Lewthwaite are two of the leading researchers, one them being a PT and one of them being PHD researcher. But both of them being women who have really done the work in this field, and so you'll see their names over and over and some other people, as well. I love this statement that's more or less summarized from one of their papers:

That enhanced expectancies warn and prepare for further positive outcomes. I just love that, warn and prepare. I'm providing some setup to my patient, usually via my verbal feedback that's going to warn them and prepare them for further positive outcomes. I'm helping them expect more, expect better. Expect something that's more positive. This impacts cognitive, emotional, and motor, so we can certainly see, oh yeah, I can totally imagine how this would impact cognitive and emotional components, but it also impacts motor preparatory activity. When you're telling them that before they're about to engage in a motor skill. Helps to influence their goal setting and increase positive affect, and it tends to buffer against responses that would detract from optimal performance. So it buffers against some of the normal negative things that may be happening that could detract from optimal performance. The last bullet point is really key. It helps to couple goals with desired outcomes. If you think back to last week

even, we started talking about coupling goals to action and here we're gonna be carrying forward with that a lot. Coupling goals to action or desired outcomes. And so that's a brief overview of enhanced expectancies. One of the things, really interesting things that falls into this idea of enhanced expectancies has to do with when you provide feedback. When you're working with a patient, and again, you don't have to chime in here with an answer, but I would like for you to just think about it on your own. When you're working with a patient, when do you tend to provide them feedback? Do you provide them feedback after good trials, good attempts, or do you provide them feedback after the poor trials or the fails? Do you provide feedback after the positives or after the failures? Successes or failures?

I think if you asked me this, maybe five, eight years ago, I probably, if I was completely honest, I would say that I provided feedback mostly after... the poor trials, the less successful. Not that I didn't provide positive feedback; I did. Good job, or good attempt, or whatever. But in terms of when I've provided specific feedback it was usually after the things that didn't go well. One person has chimed in and said positives, and that's really important because one of the things that we're gonna talk about is that when feedback is provided after the positive trials, after the good trials, it's more effective on learning. Intrinsic motivation is higher. Perceived competence, the patient's perceived competence is higher.

It helps improve or increase self-confidence and arousal management. And the evidence suggests that feedback that emphasizes good performance over poor performance may increase motivation to persist. We oftentimes have difficulty with our patients having motivation to persist in something. And that this may increase motivation to persist. Super important, and facilitate the learning process and greater automaticity. And those last two words are super important. 'Cause we talked about last week, and we have already talked about today, the importance of automaticity. If I'm truly gonna get my patient to where they can perform a task effectively without

thinking about it in a variety of circumstances and contexts, that means that they can do things with a great deal of automaticity. We talked about last week, and it's important to reflect on today, that for the most part, for most of the things that I do, motor behavior is very automatic. As I'm sitting here and talking to you guys, I'm not really thinking about the motor task of clicking my mouse to advance the slides. I'm doing some motor skills really automatically. When you walk from wherever you are now to your car or down the street, or wherever you go, you'll walk very automatically without much thought into walking. You'll be texting, you'll be talking on the phone, you'll be walking your dog, you'll be looking at the trees or the sky or, here in Texas we spend a lot of time looking at the sky saying, "When are you gonna rain?" "When are you gonna get cooler?" But I can do all of those things and not have to focus much attention on walking or on whatever motor task I'm doing because I have a great degree of automaticity. And so, if we're looking to get our patients to that autonomous stage, this suggests that one of the ways that we can do that is to think more about how we create positive self-expectancies.

How we enhance self-expectancy. How we provide feedback and whether or not we're providing feedback after the relatively good trials rather than the poor trials. For those who are already doing that, great job. But if I can be completely honest, I don't think that I always have been that way. I tend to provide feedback about what didn't go right. Doesn't mean that I was negative to the patient; I was positive, but where I gave them feedback tended to be about more the negatives. That's a little bit about enhanced expectancies. We'll continue to talk about it and autonomy together because they do merge together, and kinda hard to separate one from the other in some ways. But let's move on to talk about autonomy. We talked about autonomy being a way that we provide some choice for our patient, that we enhance their belief in themselves. So, autonomy meaning, to act following one's own beliefs and values while exercising some control over some aspect of the environment or having some degree of self control. And I think most of us recognize, again, just to reinforce the point that I made

earlier, that many of the people that we work with, no matter what setting they're in, they're in a situation where they're in your outpatient clinic or they're in a hospital, or any place in between, they're in a place and a time and a setting where they probably have lost some of that self control. For some of our more catastrophically injured, for some of our more catastrophically injured people, they probably feel like they've lost all control. And yes, Christina, you say, you said, sounds like the type of feedback during good trials optimizes learning.

So, yes, providing feedback after the good trials tends to optimize motor learning, exactly. We're continuing on here about autonomy. We've defined what autonomy means. And then we have the term competence, and competence means the ability to do something successfully or efficiently. If I'm competent in something, that makes sense, I can do it successfully and hopefully, efficiently. And when you combine autonomy and competence, you get what's called the self-determination theory. Which is really the essential stuff for psychological growth and well-being. In order to have psychological growth and well-being, I really need to have autonomy, and I need to have competence. I need to have a sense of competence and autonomy.

And so, you can imagine already, when you think about it in these terms, that if I can do something with my patients to help improve either autonomy or competence, or my goodness, both, right? I'm gonna create a situation that improves psychological growth and well-being. And certainly, that seems like that would be a positive for our patients and would probably help in motor learning. And in fact, it does. How does this all work? For one thing, again, it's that tie into expectancies. I facilitate learning indirectly by enhancing expectancy. Providing autonomy does some things really at a very neural level, though. It triggers this switching between certain neural networks that are needed for task success and it seems to have to do with more efficient goal to action coupling. Again, being able to accomplish, being able to couple what my movement goal is to the action. There's this perception that actions have effects on the

environment when I have some choice, and that is important for motivation. When I perceive that my actions have some effect on the environment, that's important for motivation. And it heightens the sense of personal agency and personal expectations for positive outcomes. So, again, you can see that link back into... expectancies, right? It heightens the sense of personal agency and personal expectations for positive outcomes. Agency, what that means, for those maybe who don't recall or didn't learn this side, I think this comes up a lot for things that we maybe took in psychology. Agency is the capacity for human beings to make choices. A person has a sense of control. This is a subjective awareness of initiating, executing, and controlling my own volitional actions and how those work in the world. If I am doing things that are going to heighten my personal agency and my sense of control, we can certainly see how this might improve my capacity for learning; it would certainly improve my motivation. What mediates autonomy? Well, again, very linked to increasing those self-expectancies.

What seems to mediate autonomy is self-efficacy. Self-efficacy being a belief in my competence to produce or to accomplish certain tasks. And it's the degree to which someone believes in their own self-efficacy. This is very much mediated by, or affects the quality or impacts the quality of cognitive, affective, and decisional processes, decision-making processes. It impacts motivation, and if you look at that last bullet point, it impacts the intention to persist. If we think about what's some of the things that we are up against in a lot of our patients, whether they are patients with neurological diagnoses, muscular-skeletal diagnoses, really any, again, the things we're talking about today cross all boundaries in terms of diagnostic groups. One of the things that happens is our patients, they start to make some improvements, they're really fired up. As we talked about last week, there's a fast phase and a slow phase in motor learning and they hit that slow phase and maybe performance, it doesn't seem to be improving as much and they lose their intention to persist. And things go downhill from there. The more that we can provide situations of enhanced expectancies and

autonomy, the more we may be mediating and improving self-efficacy, which is gonna directly impact their intention to persist. In terms of autonomy then, the question becomes: What kind of choice do I need to provide? I think we could all pause for a moment and think about, how do I provide my patients some choices throughout my treatment? Well, I guess the first question would be: Do you provide any sort of choices, any sort of opportunities for autonomy to your patients? That would be a good question to ask first. And assuming the answer is yes, then what are those choices like? What do they look like? What we know from the literature is that, choices can be something completely incidental to the task.

There's literature that shows, again, a lot of the motor-learning literature is performed, and initially especially, is performed with normal subjects in sports-related activities. There was a study that looked at folks learning to putt a golf ball a certain distance, and one group was given a choice of ball color. There's a whole bunch of different-color balls, and they were told to pick the ball that they wanted to use for practice. And they practiced with that colored ball during practice. They compared that to a second group who got the same amount of practice, practiced exactly the same way, but they weren't given the choice of ball color.

They were just handed a ball color. You would think, I would think, that would make absolutely no difference on their capacity to learn the putting task, but when they looked at the retention tests, so they took these folks through the same practice, they did the same number of practice drills, got the same number of feedback, everything was exactly the same except for one group chose their ball color and one group had their ball color chosen for them. But when you compared the retention, when you compared the actual learning of the putting skill, the group that chose the ball color was significantly better in the retention of the skill than the group that didn't get to chose the ball color. I don't know about y'all, but that's just kinda mind-blowing to me, that just blows my mind. But, what does that mean for us? That means, A: any time I

can offer some choice, it's probably a good thing. It's definitely not gonna be a bad thing. It's probably a good thing. However, we can also provide choices that are more task-relevant. So again, asking the patient: When would you like for me to provide you feedback? By the way, patients will always say, after good trials. Based on the literature, people choose: after good trials. But we'll talk about that in a second. You might ask them how often. Maybe I'm giving them a demonstration. And we talked about last week about observation and modeling, and how important that is in terms of learning so maybe I'm giving them a demonstration of a skill. Asking: how often do you want it? Do you want it before every time you attempt it? Every third time, whatever. Maybe I can give them some choices and assistive devices. I don't mean to be silly about this and let them choose something inappropriate, but if there's a couple of different devices that we can work with that are gonna give similar assistance, then maybe I'm giving them some choice in that.

I'm asking them to choose their practice schedule, sort of, how we're constructing things. There's any number of other practice conditions. Where we practice, you know? In some situations, maybe I can offer them in the room, out of the room, in the gym, outside. Maybe there's some choices about that. The order of things of how we practice. I go into a session, I in my mind know that there's three things we have to accomplish but if there's no logical reason why they have to go in any particular order, I'm gonna let my patient choose. You wanna save the hardest one for last? Get the hardest on over first? How do we wanna do this? I would encourage you to think about some ways to offer your patient some choices. Now you might say, okay, what does this look like? Can you give me a demonstration of this in patients who have some type of pathology rather than people who are just normal, and choice of balls? There was a study that was done in patients with Parkinson's disease. And they had two groups of patients with Parkinson's, both similar, of course, and they were teaching them a balance task. Essentially they had these folks learning to balance on what's called a stabilimeter, which is like a big wobble board. If you can imagine the little wobble board

that we use with patients, this is a big one for the patients to stand on. Of course it has all kinds of sensors on it to help understand where balance is, so you can know if the patient was balanced or not. And so they learned this balance task on this stabilimeter, and the goal was to hold... the stabilimeter in complete balance. The first group, group one, was given a choice. They were told, you can use this balance pole, which essentially was a pole that they would hold horizontal in front of them like a tight-rope walker. If you can picture a tight-rope walker, how they hold that pole in front of them. That is what they were given.

They said, you can use this pole to help you or not, whichever feels good to you, just choose. And so they trained, all their number of practices, using the pole or not using the pole. The second group got no choice but they did exactly what the first group did, so in other words, they were, in research term, yoked to the first group. To explain this to you, so let's say that in group one, the first person in group one was given the choice, and they chose to use the pole. That meant that the first person in group two was going to have to use the pole. They were just given the pole and said, use this as you learn the task. In other words, both groups did exactly the same practice, exactly the same way, but the group that had significantly better retention of the balance task, was the group that got the choice.

Only thing that was different was the choice. Again, and this has been shown over and over in a lot of different populations of folks to make a big difference. And again, I think of these things that we're talking about today as the low-hanging fruit. Sometimes I think that's a little bit of a cliché term that gets overused a bit, but I think of this as the low-hanging fruit because these things we're talking about today, just like talking about practice and feedback last week, these things don't cost us any money. I don't have to have really any special training or equipment to do this, I just need to think a little bit more intentionally how I'm setting up my patient, how I'm setting up the task, how I'm setting up their practice. The things that we're talking about, so I wanna think about

that. Again, we mentioned, are all choices equal? I said, you could give them something completely irrelevant or you could give them something that was task-relevant. And in fact, it seems that it's best if choices are related pretty directly to what we're attempting to have the patient learn. Again, giving them choices about the feedback that they get, of how the repetition schedule, the task difficulty, how often and how they wanna get demonstration, those kinds of things would be more directly related. And those seem to be better. And because those seem to be better, it seems to suggest that this is about more than motivation. If it was just any old choice, made exactly the same difference.

You could say, wow, it's because choice really impacts motivation, but the fact that choice is related to the task seem to be better suggests that there's more than just that motivational factor going on. That it has to do with these informational factors associated with the task-related processing, and maybe even how we help them with things like error estimation. Again, trying to think about, any choice is good. Choices that are more task-relevant are going to be best. And then we come back to this idea of social-comparative feedback which we mentioned in enhanced expectancies, and again, enhanced expectancies and autonomy being very linked.

When we think about how we give feedback, giving learners the opportunity to decide after which trials they wanna receive feedback, enhances learning; not just giving them feedback whenever I feel like giving them feedback, but asking them: what's their choice for when they get feedback? Learners typically prefer to have feedback after what they perceive as a successful trial. Which I mentioned earlier, but just to come back to it and have the citation here for it. Learners are going to prefer to get feedback after a successful trial, and interestingly enough, they know when a trial is successful. They can identify; they are very accurate about which are good trials, and which are not such good trials, which are not successful trials, and they would like feedback more frequently after the successful. When you're giving feedback after trials of good

performance, it seems to result in more effective learning. When feedback is given after poor trials, And also there's this idea of giving favorable normative comparisons. When we can let our patients know how they're doing in terms of maybe normal, that seems to increase self-efficacy, positive self-reactions, and task interest and also enhanced learning. So that means, whatever measures I'm using for my patient, I wanna try to give them information about those measures and if I can give them some normative reference, how they're doing relative to normal, that seems to be, if I can give them positive, if there's some positive feedback related to norms, that seems to enhance learning. Negative normative feedback and no normative feedback are about the same. So, giving them no normative feedback as well as giving them no feedback at all, I mean, giving them negative normative feedback, resulted in the same level of learning, which is lower amounts of learning than when they had that favorable normative comparison. And this seems to be really fast-acting, almost immediately.

When I can give them that normative feedback, when it's favorable again. And it seems to lead to different degrees of skill-learning. They have, not only a qualitative improvement in the control of movement, but more automatic movement adjustments. Again, if what we're trying to get at is more automaticity then this is one of the things that we want to remember. Because we want to get that return of more automatic movements. Again, has to do with this idea, for the patient, they're judging themselves good or poor. Any amount of feedback is gonna be good. If you see that last bullet point. Even those in the worse group, given some worse, worse than normative value feedback, they still tended to be more automatic compared to a control group that got no feedback. Again, when we can give our patients some reference to normal, that seems to be helpful. And it seems to be because there's this link between motivational manipulations to modulation of motor learning. Again, I'm doing some things which are manipulating motivation, hopefully impacting motivation, and that tends to modulate motor learning and create this positive affect. All of these things that we have been talking about, from enhanced expectancies through all the things we've talked about

related to autonomy, should serve to create a more positive affect in our patient. And again, I thought about positive affect, yeah the patient's happy, so they're gonna do better. But it's way deeper than the patient is happy. It's actually linked to dopamine production and dopamine expression. They have increased amounts of dopamine processing and dopamine expression, that we know that that's definitely linked to motor learning. Things are happening at a very cellular level to promote motor learning when we're using these motivational tools that we've been talking about.

The other thing is, is when the patient has more of a negative affect, it's thought that that can increase the need for what they term here as reallocation of attentional resources. In other words, I'm having to, again, we think about our patients with some type of pathology, they have a limitation on their resources, and now they're having to allocate their attentional resources to more self-regulatory efforts. That's going to take away then resources available for the motor skill. And also negative affect has been shown to interfere or decrease memory processing, as well. If what we're wanting is for our patient to have more automatic movements, get to that point of more automaticity, then we need to think about what are the ways that we can prevent creating a negative affect for the patient; having the patient have a negative affect. And what are the ways we can promote a more positive affect?

Again, really cellular kinds of things that occur, with that patient whether it's positive or negative affect. Also seems to be linked to focus of attention in terms of how this works. When a person has a lower self-expectancy, when they feel little control, low competency, they tend to adapt a more self-related focus of attention. More focus on themselves, focus on me. And this seems to constrain the motor system. This seems to compromise our motor system's ability to work optimally. There's been studies that show it compromises the ability to, for example, maintain steady-state posture. And it seems to result in a degradation of learning. And we're gonna talk about focus of attention in just a moment, but just know that all of these things that we have been

talking about in terms of expectancy and autonomy, when those are not happening well, and those are not occurring, they tend to have more of a reflection, or more of a focus on themselves. And that tends to constrain the motor system. Pardon me. I think just a couple more slides on this before we move to focus of attention. Just to kind of finish up talking about this. Self-controlled practice and feedback. So, if I give the patient some control over when they, how they're practicing, how practice is set up. I don't mean, saying control over do you participate or don't participate, I just mean there's some control over how practice is established and the feedback that they are given when they are given feedback. This allows, you know, again, I gave some examples there: Delivery of feedback, use of physical assistance, when we're giving movement demonstration, this enhances learning compared with when everything is controlled externally.

And the possible mechanisms, again, to just sort of go back through this, enhances motivation, results in a deeper informational processing, and seems to equate to improved retention and improved transfer. Again, meaning that those other skills that we're not practicing but that are similar are going to improve as well. I'm not sure if I'm gonna say your name right, Saida? Or Saida, I'm not sure which, and I mean, neither of those could be right. You're asking about the negative allocations. So, I think that was back here. Here. This is talking about when the person is experiencing more of a negative affect, when the situation has caused more of a negative affect for the patient, it's that they're having to reallocate their attentional resources more towards themselves, less towards the task. If I'm normally working on walking, let's say. I have a certain amount of attention that I'm putting towards the task, a certain amount that I'm putting towards other things, potentially, now I'm becoming very self-focused when I have that negative affect. All of my resources are more towards self-regulation. Rather than towards whatever the task is that I'm trying to accomplish. So hopefully that helped to clear that up. Again, as we talk about focus-of-attention, that will bring a different light to that, I think. But anyway, last point here about self-controlled practice

and feedback, autonomy seems to protect the perceptions of competence. It helps to maintain that feeling of competence in our patients, which we know enhances motor learning. Again, the example there is choosing when to receive feedback. That resulted in higher levels of self-efficacy. And they had not only improved performance at the end of practice but also superior motor learning on retention, so again, things that improve performance and retention both at the same time. These benefits of self-controlled learning, self-management was a term we used a lot last week that could go in here, too. The benefits of the self-controlled learning can be prevented or blocked if we deprive the learners of an opportunity to experience competence through good performance. How do we help our patients grow competence or feel competence? We have to drive that through good performance.

I have to, again, be able to create a practice situation which is going to be challenging and difficult because we know that's what's necessary for motor learning and neural plasticity, but they have to experience some good performance in there. I have to choose a task that's adequately difficult and challenging, but not so difficult that they won't eventually achieve that. I need them to achieve that so that they can have that feeling of competence. So we achieve that feeling of competence through some good performance. Which, again, goes back to us as rehab folks, at being the good balancer, having a really good sense of what's gonna be just the right challenge. Goldilocks, not too hard, not too soft, just right.

And then . Sorry about that. In this final slide here, before we move on to talking about focus of attention, again, summarizing a study that was done in 2012. They had two groups, both the group that received high perceived competence, self-controlled feedback, and the group that received only self-controlled feedback. One group got both: High perceived competence and self-controlled feedback, the other group got just self-controlled feedback. They both... experienced high self-efficacy, performed with greater accuracy and less variability. In other words, they had good performance

and retention as well as this sense of high self-efficacy. It may not be that both of those ingredients are necessary. It could be that one of those ingredients is necessary. Maybe there's some additive effect. This is being explored in the literature, and we'll talk about in a little bit whether or not there's an additive effect of all these things that we're talking about. But again, there's no harm in doing all of these things. May not be completely necessary, but in fact, still not clear whether there's some additive effect when we combine these factors that we're talking about. In a different group that had a lower perceived competency, that we know that that has a negative effect. A higher perceived competence plus self-controlled, again, may not have to have both of those, but we certainly wanna create a situation where we have one or the other. So we'll move on to talk about focus of attention.

Focus of attention, sorry, is something I know I didn't learn about in PT school, starting out, for sure. And it's really only been talked about in the last, probably, again, I would say decade to, maybe working on coming to a couple decades. Somewhere between 15 to 20 years, probably we've started talking about this. But really in the last decade there has been just an explosion of information out there and evidence out there on focus of attention. So let's talk about first, what does that even mean before we figure out how we use it. Anytime we're doing a motor task, we have some type of focus of attention. And it's either external or internal.

Any time I'm doing, if you think about, you know, I'm reaching to pick up my can of soda that I'm drinking here. As I'm doing that, I have either an external focus. An internal focus would mean I'm focusing on my arm moving towards my arm as it's moving. My focus is on how I'm moving my arm and what my arm is doing and all the things about my arm and the movement of my arm. Versus an external focus of attention, is about the effects of the movement on the environment. If I have an external focus of attention, I'm looking, literally, at the can of soda. I'm focused on one thing and that's the can of soda. And get getting the can of soda. My arm movements,

they're just happening. I'm not really focusing on those. I'm not looking at my arm, I'm not thinking about my arm movement; I'm thinking about get the can of soda, which I just did. Okay, so we have a focus on the effects of movement. That's external focus, and we have internal focus. That's a focus on the body movements, the parts that are moving. And so, as therapists, as people that are helping people relearn, we can promote one or the other of those focus. When we, I guess foci would be what I shoulda said there. We can promote an internal or an external focus by our feedback that we give the patient. When I promote an external focus, when I drive the learner's attention to the effect of the movement, that seems to enhance performance and learning. Performance is gonna get better. Learning is gonna get better. Both, so performance and learning, or retention, if you choose that word. Both of those are gonna get better when I promote an external focus, and it seems to promote more automaticity.

Again, more of that automatic movement that we're trying to get back to. Because if we think about motor learning, it means that my patient can do the movement effectively without thinking about it in a variety of circumstances and contexts. That's automaticity. So, it promotes automaticity. If you think back to the guidance hypothesis earlier, both from last week, and we reviewed it again at the beginning of this session, we talked about the guidance hypothesis says, that too much feedback is bad, essentially. That's summarizing it down. Too much feedback is bad and we can become, as a learner we can become dependent, or reliant on that feedback and that obviously would be bad. However, when you provide feedback with an external focus, it does not negatively impact learning or retention. I can provide feedback over and over and over again to the patient with an external focus, and it does not seem to impact, in a negative way, learning or retention. However, if I provide frequent feedback with an internal focus, it does seem to decrease motor learning. It seems like that guidance hypothesis holds true only for feedback that has an internal focus. It doesn't seem to hold true for feedback that has an external focus. Hopefully that makes sense

to you. I'm directing attention away from the actual movement. I'm directing attention to the result of the movement, to the impact of the movement. Versus in an internal focus, I'm directing attention to one's movement. Why do you think this is so? Why do you think that an internal focus seems to not promote learning and an external focus does? Well, if I'm giving you something to do, raise your arm above your head, and the attention that I'm giving you, what I'm instructing you to do is focus on your arm, so I'm saying things like: Lift your arm above your head; raise your arm higher; flex your arm more. All of those kinds of verbal feedback that I'm giving, those are very internal focused.

I'm directing you as the learner, your attention, to your own movement. And this results in conscious control. You have a high consciousness of the movement you're doing. One of the things that we know is that automatic movements are not under conscious control. They happen automatically. I don't have to take them up to the tip-top of my brain and roll them around through various cortices up there, impart a lot of cognitive input there in order to have those movements happen. Automatic movements are subconscious, subcortical kinds of movements. Most of things that we do motor-wise fall into that subcortical, subconscious kind of movement. That's what we define as automatic movements or automaticity of movement. So when I put your attention to the actual movement that you're doing,

I'm sort of putting you into a conscious control mode. And that disrupts automaticity. It's the exact opposite of it. And it may lead to some superfluous muscle activity. We're gonna talk about the EMG studies that have looked at this in a second. But it may create extra muscle activity that's not necessary, that's not needed. Over-recruitment, overflow, and it may lead to what sports psychologists would call choking. Or sort of having, we're too much in our head, therefore we can't move the way that we should normally, easily be able to do. How does this work? External focus of attention directs attention to the task goal. Again, this has become a familiar theme. Goal to action

coupling. It directs attention to the task goal. It reduces the focus on the self. Puts the focus more on the task, the goal of the task, and takes the focus off the self. Again, connecting the goal to the actions. And this tends to increase success of the movement, which in turn is gonna enhance outcomes. It creates this positive loop. I have less focus on myself, I have better performance, I have better retention, therefore I've created more positive affect, and now you can imagine this positive cycle that we have going here.

I mentioned earlier about EMG activity, and how that internal focus sometimes can create these superfluous movements, movements that we don't even need. What we know, when you give an external focus, there's an increased accuracy of the movement, an increased accuracy in the task, and there's actually lower EMG activity. You might be thinking, lower EMG activity, that doesn't sound good. Don't I want higher EMG activity? Well, no, you want the most economical movement possible. And so when you look at comparing EMG activity in a person that you're giving external focus of attention to internal focus. In the external focus condition, they have what they term as enhanced movement economy.

They have more effective coordination between the agonist and the antagonist muscle group and you have more discriminate, finite motor unit recruitment, you don't have a bunch of noise. Noise meaning, a whole bunch of stuff that's working at the same time. And we know that our patients, we see this as a common problem in our patients, just under routine conditions. They have over-recruitment very easily. They try to move, and they have recruitment of muscles that don't need to be activating, they have recruitment of the antagonist when they need to just have isolation of the agonist. We know that they have what we call 'spread' of muscle activities. So, they try to activate one area, but then they sorta have this spread of activation in more than one place. Or in more than one area of the limb or in the body. And this EMG under an internal focus, you see more of that spread, less refinement. In the group that has external focus you

see none of that spread, and a much more discrete activation pattern. Definitely things that we see already occurring in our patient very readily, we want to promote the opposite of that happening, so if we can help them have a more refined movement, less EMG activity, less overall recruitment of activity, we certainly wanna do that. Imagine if it's just something as simple as giving them an external focus of attention versus internal. Why does this work? If you read the literature, they talk about something called the constrained action hypothesis, and essentially what this said, and we've already alluded to this is, conscious attempts to control movement come from an internal focus.

When you have an internal focus of attention, you shift your conscious drive to try to produce and control movement. And this seems to almost bind down, or constrain the motor system and it takes us out of automatic mode. It disrupts those automatic control processes that we want to have happen. When we have a focus on the movement effect, or an external focus, it allows more of an unconscious, automatic process to control movement, which again, as we've said, results in more effective performance and learning. If you think about... The example that I always like to give is Shaquille O'Neal. Shaquille O'Neal is famous for A: Being a really great basketball player but he's kind of infamous for not being able to hit a free throw.

When he steps up there to the free-throw line, he misses a majority of them. You can just almost see him thinking about the free throw when he gets up there; he's very much in his head. And you hear that term a lot in sportscasters, talking not just about Shaquille O'Neal. Somebody misses an easy layup, and they're like, oh, he was wide open, he just got inside his head. They start thinking about the movement too much. The people who are really successful free-throw shooters, take the ball, they have this thing that they always do. Everybody's is different, but maybe it's bounce the ball twice and spin it backwards, or whatever it is that they do. But you can see that there's no real thought involved. They do whatever they do and they toss the ball up there. And it

goes in every time; looks easy, very easy. Those are the people who are not focusing on the movement that they're doing, they're not focusing, they're not thinking about what their body's doing, they're focusing on one thing, and that's the target, that's the basket. And so when athletes deviate from that, you can see this choking phenomenon that we talk about. And probably it's because this constraint on the movement system because there's too much cognitive, too much cognitive activity going on. Sort of a cognitive overload. Kathy says she's found that alternating according to the patient's ability, is most effective. You have an internal focus for pre-learning, and an external focus for learning. For some reason I can't see all this. I can't, hmm.

There's more written there but I can't see past that, Kathy and I'm sorry, oh, thank you, for whoever just expanded that. Or internal when the patient can focus on a task and education that the goal is for external carry over. Okay, so, doing a mix of both. Yeah and I don't know that there's anything wrong with that. I think the literature's pretty clear that we want to, as much as possible, shift towards that external focus. I'm not saying that I don't ever give some internal focus information, some internal focus feedback, but I want to be, my goal was to be shifting them to that external focus as quickly as possible.

But thank you for that. I think that that's probably a good strategy as well. There's some other thoughts about, that it has to do with, if you can think about the distance between the action and its effect, and so, again, when you focus on more the distant effects, that tends to enhance learning versus more of a focus on the proximal effects. Meaning, I'm focusing more on the limb that's moving. That tends to actually degrade performance and learning. You can think about it that way, too, in terms of distance from the actual moving part to the action, or to the effect of the action. This has been looked at, I've kinda given you some sports examples here, this has been looked at in a variety of different people, a variety of different settings. I have a slide coming up that I'm kinda talking ahead of, but this has been looked at in all kinds of sports, in all kinds

of people with various pathologies, and this tends to hold true by and large, most of the time. However, I did wanna put in here, 'cause I don't wanna ever sound like I'm just selling everybody a bill of goods with no, this always works kind of thing. This was a study that was done just recently, couple of years back now, looking at the effect of attentional focus in upper-extremity training in folks with chronic stroke. It's important to point out, these were folks that had moderate to severe impairment in their upper extremity. They had two groups, they did four weeks of training with a robotic device, and when they compared, they found no difference in retention, comparing whether or not they spent their time with an external or an internal focus. They're saying that maybe it's related to carnosity, or maybe it's related to the severity of the motor impairment.

But for whatever reason, that didn't hold true here. It's worth making sure that you understand, it didn't say that an external focus was worse than an internal focus, it just, neither was superior to the other. And so I would keep that in mind. When something is not necessarily worse, but in other situations seems to be superior, I'm probably gonna opt for still keeping that in mind, and still trying to direct my patient's attention more externally rather than internally, but in this situation there was no superiority in this patient population.

But I will say, at the very last part of their conclusion, the thing that was seen to be pivotal was dosage and practice. So, again, that's a whole 'nother discussion to talk about intensity of practice and dosing. But what seemed to be pivotal, more pivotal than the focus was dosage and practice. And I would absolutely line up with that statement right there. Looking at things like focus of attention and expectancies and autonomy can certainly enhance motor learning but I think we still, at the end of the day, think that dosage and practice appears to be what's most pivotal, all the time. So, Denay says: Thinking of a patient who is moving in a flexor or extensor pattern, it feels like quality of movement is going to suffer from focus on external goal versus quality of

movement. No, I would kinda disagree with you there, just in my experience, Denay. When I get my patient to stop thinking about how to do the movement and just focus on the target, the movement is almost always, in terms of quality and quantity, I would say I see improvements. I don't think it necessarily has a negative impact on quality. So, Amy says: I work with pediatric patients who often have cognitive impairment according to focus on external versus internal. I should not say, put your foot on the step, but I should say, step up. No, put your foot on the step is an external focus. I'm just not saying: Raise your leg, extend your knee, whatever are the movements that correspond with that. No, absolutely, put your foot on the step. Hit the dot, hit the square, hit the color, whatever. Those are great external focus activities, yeah. Thanks for clarifying there. Again, this was the slide I was talking about that shows the different populations that this has been looked at. Again, lots of people with disabilities, all different age groups, all kinds of different sports tasks.

This is a growing and thriving body of research that's getting added to every day. I mentioned earlier, is this additive? Should we do all three? There have been studies that have looked at that. Whether or not you get a benefit from adding just one versus adding two, versus three. And what they've found is that, yes, it does seem like there is some additive effect, that those who receive a combination of two did better in terms of learning relative to just having one. Practice that incorporated all three resulted in more effective training than those that included two. So again, there seems to be an additive effect. But I wanna go back to this slide here, because this is what I wanna sum up here, is that these are all incredibly easy things for us to incorporate into our therapy session. It really just takes one thing, and that's intention. It takes intention on how I set up my practice; it takes intention to provide that autonomy; it takes intention to think about when I'm giving feedback and be more careful to give feedback after the good trials versus the negative trials. It takes some intention in constructing a task that has more of an external focus, maybe, than an internal focus. But all, again, to use that overused term, all really low hanging fruit. And in the last two slides that I have here in

this section are some nice summary papers to look at. In 2016 this was a paper published again, by Wulf and Lewthwaite called "The OPTIMAL Theory of Motor Learning". And OPTIMAL stands for: Optimizing Performance Through Intrinsic Motivation and Attention for Learning. If you want to just look at a paper that has more information about what we've talked about, that's what this paper was about. They wanted to look at the motivational and attentional factors that contributed to performance and learning by, again, by strengthening that coupling of goals to action. They talked about that enhanced expectancies and external focus propel the performers' cognitive and motor systems in productive forward directions and prevent more of that backsliding into the self or into non-task focused states.

Essentially, they describe that when you can increase the patient's focus on the goal, and decrease the focus on the self, that's gonna result in, and when you combine that with providing some autonomy, some enhanced expectancy, and some external focus, those all increase the goal to action coupling. So that, again, creates a situation where you have more focus on the goal, less focus on the self. That's gonna improve motor performance and motor learning. And again, that improved performance and learning is going to cycle back to even greater improvements in competency and self efficacy, higher motivation, greater feelings of autonomy, and so it becomes this very positive cycle.

Whereas if you don't provide that autonomy, that you don't enhance their expectancy, you give more of a focus that's an internal focus, that tends to drive up the focus on the self and that big internal focus and a smaller focus on the task is gonna then be detrimental to performance and detrimental to learning, which then is gonna give a negative input back to our autonomy, competency, self-efficacy, all those motivational factors, and become more of a negative cycle that's repeating as opposed to a positive cycle that's repeating. And another study that I would point you to, that I think is a good practical application of these things is the ASAP program, or the Accelerated Skill

Acquisition Program that was published in 2014 by Winstein et al. This was a study that the goal here was to create what they called a principal-based intervention for neuro-rehab. And the principals, there was eight, I've just pulled out a few of them. The principals were really combining all the things that we've been talking about, things related to neuroplasticity and intensity of practice and dosage, which we sort of mentioned on the fringes. And to couple that with things related to more of these motivational and cognitive factors that we've been talking about today. Just a few of the ones that they hold in high regard are: Ensuring challenging and meaningful practice; enhancing capacity through overload and specificity, again, that need to create something that's difficult and has a pretty decent intensity to it. To preserve natural goal-directedness. Again, we have to have that action to goal coupling. Driving task-specific self-confidence HIGH through performance accomplishments. Again, that's the Goldilocks principle there. That I'm gonna improve their self-confidence through performance accomplishments. I need to be able to balance something that's challenging, but something that they're gonna be able to accomplish in order to build their self confidence.

And so, again, that's just a paper that I would point you towards that may give you some good ideas of how to put some of this into practice. A couple things that are a little bit off-topic, but that I wanna cover quickly, and then we'll have some cases. They're off-topic, but I think they're very linked. We mentioned last week the power of observation is a very viable way of practicing motor skills. Again, having a patient observe a person doing a physical task, you get activation in the same parts of the nervous system as when the person actually practices the task. Just like mental practice. It's kind of on the same order as mental practice. The observation of other learning, of other learners, I'm sorry, performing these motor tasks increases training efficiency. Again, if what we need to do is get our patients faster at getting better, getting better faster, in less time, getting more therapy outside of therapy time, observation is a great way to do that. If you combine that with motor imagery or mental

practice, use those terms interchangeably, if you combine those two, then you essentially get even more bang for the buck. You can use these separately, you can use these together, but you're going to get, again, increased activity in those motor regions, increased activation of those areas that we want them to be working and accessing more readily. So a couple of ways that we can do that outside of our task-specific practice. You can't just have the patient doing active observation and mental imagery without any task-specific practice. It has to be coupled with that. For example, in this study, this was balance training, they had to have that coupled with the actual task-specific practice of balance. They found that in both groups, the group that got mental imagery, the group that got both combined, there was significantly decreased postural sway.

And again, there's some mixed evidence that says, yeah, this may actually be, this may actually be additive, so practicing these two together or having them use these two together, not a bad thing. It doesn't really take much more time. I just wanted to make sure we circled back to that. We talked about mental imagery and a little bit about observation last week, but I wanted to make sure that we came back to that. The other thing that seems to be really important if we're thinking about motivation, has to do with celebrating our patients. And promoting celebration of our patients' accomplishments. Remember, we wanna drive their self-confidence high through task accomplishment.

When they have that task accomplishment, we wanna make sure that we celebrate that. I put this into this presentation based on something that was in WebPT some time back, that was talking about celebrating your therapy gains. That's what sparked me to think about this. Before we move on, let me see, there's a question here. When you say: Observation of other learners, are you meaning observation of people with similar injuries? Or can they observe normals? It kinda depends. I think normals are good, however, if it's movement that's really specific, like, I always think about patients with

spinal cord injury. A patient with a spinal cord injury watching me do bed mobility or transfer, may not be as helpful as watching someone with a similar type of injury who has more skill, do the skill. 'Cause I oftentimes can't imitate what it is to look like. But if I think about my patient with a stroke, who I'm trying to encourage very normal movement. I'm trying to encourage them to use both sides more symmetrically and so on and so forth, then I think observation of a normal is probably good. It depends on the movement and they type of patient that you're talking about. But observation of normal can certainly be good. For some patients, you may want to have observation of a peer, meaning, a similar type of injury. If that is important to the situation. Again, I think about like in patients with SCI that becomes important to the situation. Hopefully that clarified your question.

If it didn't I can come back to that. They talked about when we cheer on our patients we help with that lack of engagement. We help with that connection. That's certainly something that dogs us in our rehab as our patients become disengaged and don't connect. The solution that they offered was to celebrate therapy wins, have that positive reinforcement that we've been talking about, and to help make it stick. And one of the things that they emphasized was that generic praise wasn't enough. It had to be praise that was specific to what the patient actually accomplished.

Not just a good job, 'atta boy kind of thing, but something that was more specific in order to get true engagement. I put these questions in here for you to think about in your practice: How do you get more engagement with your patients and how do you celebrate their therapy wins? I always think about when I was a young PT student, I spent some time working in a clinic, and I had an older therapist who was a mentor there, and she had the loudest, I won't do it in her voice, but when a patient did something good, you would hear them from across the gym. You'd hear her let out this whoop or this woo-hoo. She genuinely celebrated that patient's accomplishment. I think that that's something important for us to keep in mind: Therapy is hard. This

whole process is hard. We need a little bit more celebration. And the other thing that I would add to this, again, thinking about how we promote these motivational concepts is being truly patient-centered. And I'm gonna go a little bit quickly through these slides because again, I wanna make sure we have time for talking and integration. We all say that we're patient-centered. The definition of patient-centered means: Providing care that's respectful to, and responsive to, individual patient preferences, needs, and values, and ensuring that patient values guide all clinical decisions. So we all say that we're patient-centered. It's in every one of our mission statements, something along those lines. However, I really would like for each of us to pause, do a little self reflection about how patient-centered am I.

Because are the patients' values truly guiding all of your clinical decisions? Are the patients' preferences, needs, and values being addressed; not met, we can't meet them all. But are they being addressed? Oftentimes, we think that patient-centered means that I ask the patient what their goal is, and I write that down. That's not patient-centered. We start being patient-centered by using patient-first language. This means, not referring to people as their diagnosis. This means referring to people as people. I probably shouldn't even use the word 'patient' over and over again, I should probably use the word person.

But we fall prey, really easy, to referring to patients by their diagnoses. I have a hip, I have a back, I have a stroke, whatever. My stroke patient, this stroke patient, those are not patient-first language. That's not using patient-first language. Here's what one group says about patient-first language: Our words and the meanings we attach to them create attitudes, drive social policies and laws, influence our feelings and decisions, and affect people's daily lives and more. How we use them makes a difference. People First Language puts the person before the disability and describes what a person has, not who a person is. Using a diagnosis as a defining characteristic reflects prejudice, and also robs the person of the opportunity to define him or herself.

I'm not saying that any of us who, and we all do at times use non-patient-first language. I'm not saying that we do that in a malicious way. None of us are intending to be prejudice. None of us are intending to rob the person of the opportunity to define him or herself, but when we don't use patient-first language, I think that's one of the ways that we take away from motivation of our patient, when we refer to them as their disability or their diagnosis. As opposed to more of them as the person. And so that's just a little pitch that I wanna make, to use that. And then, again, just thinking about how these principals of patient-centered care. Having respect for the patient's preferences. Truly having respect for the patient's preferences.

Again, that doesn't mean when they say, I don't wanna do therapy, that you're just like, oh, okay. But really having some respect and taking into account the patient's preferences. Having coordinated and integrated care that focuses around them being the center. Providing good information and education. Providing as much physical comfort as we can. Rehab shouldn't necessarily be painful. We want to try to provide as much comfort as we can, as much emotional support as we can. Involving the family and friends, having as much continuity and transition of care. Trying to ease those transitions of care, providing continuity between practitioners that's seeing them, and obviously, giving them good access to care.

Some of us as frontline clinicians, we may have less capacity to impact some of these, but all of us can have respect for patients' preferences. All of us can help to provide physical comfort and emotional support. And I say this, again, because, again, seems a little bit off topic, but I think when we're truly patient-centered, we help to drive forward that motivational component of motor learning which we know is so important. And then my last plug here is about patient-centered goal setting. I think the way in which we are very, very patient-centered has to do with patient-centered goal setting. I think that this enhances everything about the patient's experience. It's gonna improve outcomes and satisfaction. Yes, it's required, or recommended by our practice. We

certainly ask the patient their goal. But we don't always incorporate that into what we're doing with the patient, we don't incorporate that into the goals that we write, oftentimes. But really critical for motivation. There was a study that looked at, is patient-centered goal... writing, goal setting, is it actually happening? And I'll just summarize for you. No! It seems like, if you look at the last bullet point there, rarely straightforward translation of patient wishes into agreed-upon written goals. I go in, I ask Mr. Smith: What are your goals for therapy? Mr. Smith tells me the goals, I write them down. And then I create a list of goals for the patient. If I share those with the patient, they should look similar. The patient should be able to recognize his or her goals in my goals; I don't mean they have to be exactly alike. If my patient's goal is really unrealistic, then I'm gonna work with the patient to then choose some more stepping stone goals to get there.

Or I can, within the goals I set, help my patient see these are stepping stones to get to your big goal. We need to have more agreement there. I think when we do that, the patient's going to be more motivated, they're gonna feel more like they have more competence and a little bit more control and we know that those have very positive effects on motor learning and neuroplasticity. And I just love this goal, I mean, this quote. "Only the patient can make the decision "that a goal is worth working for." So, if my patient didn't make the decision that a goal I wrote was worth working for, they're not gonna work for it. Can pretty much just guarantee that. Can't dismiss this idea of... motivation and we can't dismiss how connected motivation is to being patient-centered and writing patient-centered goals. Just a little bit of a tangential, almost soapbox thing there, but hopefully that made sense and falls in line there. Martha says: Interesting is the correlations of ideas you present in regards to pediatrics. Parents constantly express the lack of performance of their child as because they are lazy. My response is always . So, Kathleen, can you enlarge that for me again? I don't know, I can't see past my response is always. Can you make the box bigger for me? Thank you. My response is always, the child does not know what

laziness is. The idea of motivation is very complex and difficult to explain, yeah. Risk for the child to become, oh it's down here, risk for the child to become dependent on the positive feedback. There's nothing simple about motivation at all. Absolutely, and I think you're right on. I think oftentimes, especially children, no, they don't have the concept of laziness. But the thing we have to remember is, no, we can't be the motivation for anyone. I can't motivate someone, but I can create conditions which hopefully enhance their motivation.

It's not about me motivating the patient. 'Cause we all know, we can't be somebody's motivation. But what I'm asking you to do is think about how, in your therapy, in how you create practice, in how you intervene with the patient, that you're creating situations that are going to enhance motivation for that patient. Are we always gonna be successful? Absolutely not! There are some patients who just, are beyond motivating. I'm not telling you how to fix those folks, 'cause I don't know how to fix those folks. But we need to attend, I guess the bottom line is, is attend more to what's motivating to our patients. In the situation of children, it's a struggle because they can't always tell you what their interests are and what motivates them.

You have to be much more, as you know, Martha, much better at our observation skills, to observe what seems to motivate them, and try to tap into that. Does family improvement improve changes for motivation? I think that highly depends. I think that depends on the family. I think sometimes family involvement is not good for motivation. I think that we have to judge that. It's definitely not a given. Usually the parent sets the goal if they want to achieve. Absolutely, and if the patient can't be the center focus in terms of the goals, then the patient's caregiver or the family, they are the person that established that. We have to go with that. Again, even if it's that caregiver or the family that's setting the goals, we need to make sure that if we're going to be focused, if we're going to be patient, or you might say, patient and caregiver, the caregiver-unit-focused, then we need to make sure that those are really a part of the

goals that we are writing for therapy, as opposed to not. Hopefully that makes sense; those were good comments. Kathleen, I'm . It's weird, my screen, I'm losing, I don't have the little X now to be able to close out those comments. If you could close those out so I don't go back to those, that would be great. If we think about what are some common themes in what we have seen here, I think the big one is this goal to action coupling. My patient needs to be able to see the goal. Thank you, Kathleen, now I see them. Needs to be able to see the goal, needs to be able to be motivated towards that goal. They need to be really linked. So, in all of my therapy sessions, there needs to be a really clear goal. A really clear focus on what is the, how do I know when I've met the goal? How do I know when I've reached the target?

We need some clarity in that. We wanna make sure that everything that we're doing is trying to link in what we're doing to the goal. Let's put all of this together with some patient cases. Have a couple of videos. And so, what I'm gonna have, I think how this is gonna work is I'm gonna have you watch, we'll watch the first video of this patient and then I'm just gonna ask some questions. Now, if you want to type in answers, that's fine, and I will try to get to everybody's answers. It sometimes can get overwhelming when there's lots of folks replying, so if I miss your answer, please don't feel bad about that. Mainly what I want you to do is to think of your own answers and response to this, whether you type them in or simply jotting them down for yourself, or just thinking about them.

I'm gonna pose some questions to you about how you would integrate some of this material, and then I'm gonna give you my thoughts about that. The thoughts that I share with you are just how I would approach, how I might integrate some of this information into these patient cases. Certainly it's not a right or wrong answer. This is really, I want to give you guys an opportunity to think about how you would utilize this material. Before we move on, Tera says: I've noticed a lot when I'm teaching single-point cane gait, if I break down the tasks to steps, the patient does not get the

task. But when I tell him: Just walk, they get the sequencing. There's a really good reason for that, Tera, that's an excellent observation. And you're absolutely right, and one of the things that we talked about last week, not sure if you were in that session or not, one of the things we talked about was whole versus part practice. And we talked about, so what you're saying, when you break it down into the steps, that's the parts. And one of the things we talked about is, certain tasks just don't lend themselves to that strategy. And walking is a continuous task, and so that means it doesn't really have discrete parts. Breaking it down is really not suggested. So that's why, you're right on in your observation. The other thing is, is when you say: Just walk, you shift into that automaticity. I have oftentimes just taken my patient's hand, and said: Okay, let's go, keep up with me! And I just take off, and I don't drag them along, I have some thought about this, but I have them walk at a speed faster than they would normally go because they're keeping up with me. That puts them, that shifts them into that, more of that automaticity.

So that's a great observation. Kathy says: I had a mentor who said, with a hip patient once that the textbook rehab for range of motion and gait let them stay on the page of the textbook, but using this to get patient back on the floor to play with the, oh, okay. So you had a patient who had some hip issue, and you're saying the textbook was range or motion and gait, but the patient's goal was to get on the floor and play with their grandchildren. Yeah, then we can't be on the textbook page. We have to think, yeah, so absolutely. And maybe with that patient with that diagnosis, that particular goal of getting on the floor, maybe that's not what you're gonna meet in your practice setting; if you're in acute care you may not get to that. But I at least need to make the goals that I am writing, again, be the visible stepping stones to get to that patient's goal. And I have to, for some of my patients, think outside of the box, or off the textbook page, as you mentioned, in order to get to that. So let's watch video one. In this video, this is a gentleman who has left hemiplegia. And the therapist has asked him to, she just asked him to sit up on the edge of the mat. She didn't give him any

instructions. She's trying very hard not to help him too much. She's allowing him to struggle a bit. When he can't complete the task, each part of the task, she helps him some. Okay, so let's watch that. Go back here and let's watch that again. She doesn't tell him how to do the task. She just says: Sit up on the edge. She gives him some time. We talked about delaying our feedback. Allowing the patient to have some time to process what's happening. Or not happening. She helps him complete the task of getting over onto his side. And then she lets him attempt to push up. And like many of our patients, he runs out of room because of poor placement of his arm. Okay, so, I don't want to get into questions or thoughts about handling necessarily, but if this was your patient, I want you to think about what would be some of the feedback that you're giving him here, how might you change your feedback that you're giving him with some of the information from this class? What are some things from, based on this class, or even from the course, part one before this, what are some things, ideas that you might pull forward to help this patient be more successful?

If you notice, the first thing, the patient doesn't seem to move any part of his body very well. He has left hemiplegia. And he's not really, he is doing a great job with his strong arm. He's doing a great job with that. But the rest of his body, his strong leg isn't really moving like it should; it's doing some weird things. Definitely giving some positive feedback about what's positive, so Christina, yeah, Christian, that's great. I might, maybe watching another person log roll and asking him to mimic, absolutely, Jennifer. That was kinda the first thing that I put on my list, is having him observe. So, after he did it this first time I'd be like, wow, he just doesn't have a motor plan for this. He doesn't have a pattern that even makes sense. Because one part of his body isn't working well, it's disrupted his whole capacity. First step might be to have him observe another person, or me, or whatever. A patient do some part of this might be good. What else? Potentially, is there a way how we could've integrated an external focus? We don't know what the therapist was saying to the patient. But certainly we could've given some external focus about where he needed to end up. He was using his arm

kinda. We could've given him a more meaningful focus of where to put that arm. That might've helped drive that movement. We could've given him a focus, an external target, maybe to get that right leg doing in the right direction instead of the wrong direction. Reaching for the edge of the mat, yep, that encourages an external focus, absolutely, absolutely. We certainly could give some tactile cuing, but again, we wanna think about not, yes, we could give tactile cuing, we wanna make sure that they're not becoming dependent on that tactile cuing. Hugo, you said: Break into parts. And certainly we could've implemented some part practice here. Bed mobility is actually something that does lend itself well to part practice, and we could've broken this into some parts. Wendy, you have an interesting idea: Maybe ask him how he sees himself achieving the task. Yeah, so what part of that? Did you achieve the task or didn't you? What parts of it did you achieve? Giving some cuing, not giving feedback, but giving some cuing for his use of his intrinsic feedback. How did that feel? Where do you feel like you were successful? Where were you not successful?

I love that; I think that that's really great. Kathy says: That's probably the way that he got up before. Absolutely, he's a man, that's a very, I don't mean to be stereotypical, but that's kind of a man pattern there, to do sort of the sit-up method. And our patients, oftentimes, can't do that. And so, in which case I might have to be like, okay, we're going to have to maybe teach you a different pattern and go through some steps about why that is, but yeah. So maybe I'm teaching him to acquire movement, but not reacquire it exactly the way that he did it before. Right, yeah. It's pretty common that people wanna stick with that. You can verbally instruct step by step, absolutely. Again, you wanna think about, I would always think about first, just giving them the target, the end move, the end goal, and see how they do that before I give my step by step instructions. And I would try not to give much instruction while he's attempting the movement, because then he's focusing on my instruction and not so much on feeling and learning the movement. Some of that, yes, but I would try not to do that just kind of all the time. Some other things that I thought about would be, again, I think we said

this, especially the person who talked about the arm: Feedback after the successes. How could we get some autonomy here? Maybe we could have the patient choose which direction to roll to. He's actually rolling the direction that should be easiest for him, just given the side of his weakness. But we could give him some opportunities to make some choices about which direction do we want to practice rolling? Which direction do we want to practice coming up to sitting? I could've, if we, especially the person who suggested part versus whole practice, maybe when I simplified the task or gave him a part, made it maybe easier for him to accomplish, then I want to make sure that I'm establishing those expectancies by saying things like: Okay, so, I've made this change, maybe I prop him part of the way towards rolling; maybe he doesn't have to roll all the way. Now I definitely believe you'll be able to accomplish it now.

We've made one thing easier. I think you will definitely be able to accomplish it. That sets up that expectancy, again, that he'll be able to be successful at the movement. I need to be a good predictor that that's gonna hold true. But yeah. Katherine says: Practice rolling side to side and bridging side to side. Yeah, absolutely, there's other things that we can have him do besides this one particular task. Yeah, we could break it down into some parts. Good, let's go to the second video.

And this gentleman, also doing a basic mobility task. He has right hemiplegia. And the therapist, don't judge the therapist. The therapist is being told, just don't let him fall. But don't help him; the therapist is killing him 'cause he really wants to help him. He wants to set things up and help him do it more successfully, but we're trying to get the patient's just sort of, cold performance here. And he's just being asked to stand up, not given any cues about that. This is super typical of our patients with hemiplegia. You see lots of asymmetry, overuse of the stronger arm, overuse of the strong leg. Absolutely, there's things there that are very typical. So if we think about this, and we're trying to, and our goal here would be, he's sort of a cheating sit to stand, but he doesn't really look very safe, there's tons of compensation versus recovery. What

would be some of the things that we've talked about that we could maybe have this gentleman practice? So, Mary says: Mental imagery would be effective. Would mental imagery? Yes, so, this guy obviously can't practice sit to stand outside of therapy; he can't go practice this in his room on his own 'cause he's not safe at all. But mental imagery is a way to do some practice outside of therapy, if we combine task practice of sit to stand with some mental imagery. As with some observation, the things that we talked about for the last patient. Observation and mental imagery, or combining the two together, those could both be really effective ways to help improve his motor learning here. I think that both of those would be great. How do we maybe build success for this patient? Sandra said: Absolutely would have him watch me do it first, observation; absolutely, that's great. Feedback using mirrors, absolutely, I think that that can be good. Just know that every once in a while, mirrors can be confusing to your patients. And sometimes mirrors can be sad to your patients if they don't look the same as they once did.

I agree with you, I think the mirror can be a great tool. But just know that sometimes not super great. Certainly there's things that we can change about the task and we can break it into parts. And one part could be scooting forward, Wendy. And emphasize putting those parts together. Absolutely, yeah, elevate the mat, Katherine. So that he has a little bit more success. If I raised up the mat, he probably could do it more successfully and with less compensation. So it's going back to that idea of the challenge point, which those of you who were in the last session, it's finding that challenge point, and then being able to build on it. He's sitting down super low. He's a tall fellow with really long legs. I don't have to make it this difficult. I could find a different degree of difficulty that he's gonna be able to demonstrate some success, build some confidence, and then keep adding on to that challenge from there, so absolutely. So Hugo said the same thing: Raising the table, absolutely. Demonstration, return demonstration, absolutely. Breakdown into parts, absolutely, that was a great one. Part versus whole, good. That would also be appropriate. Verbal cues, sure, we

could certainly give some verbal cues, we could also give some external focus. We could give external focus about where his feet need to be, we could give external focus about how far he needs to lean forward instead of telling him to lean his trunk forward. Oftentimes I give my hand as a target. Touch your chest to my hand. When your chest touches my hand, then you can lift off kind of thing. Yep, absolutely, elevate it and have him work through how he feels, what that feels like.

Give him something to reach for, nice external, absolutely. Certainly you could have a gait belt on for safety. But not necessary, I mean, it may be necessary in your facility, but not necessary. So, I could give him a hemi-walker, Katherine, but that would probably promote even more compensation if I put the hemi-walker on his left side. If I put the hemi-walker in the middle and had him put his left hand on the hemi-walker in the middle, that could promote more of a weight shift to the right. But again, we're thinking about how do we promote motor learning as well as promoting more normal movement patterns, so those were all good. If we go back to the slides, I do wanna quickly go through this last patient real fast. I have a paper patient for you here. This is a guy who's had a stroke. He's extremely fit but he had a really bad stroke resulting in right hemiplegia and some expressive aphasia.

You can see his strength there. Improving strength proximally. Not so good strength distally. His gait speed's pretty slow, 0.5 meters per second. With the typical, not-good pattern. His goal is to walk without the assist of device, without the AFO, return to his household chores of yard work and taking care of the pool, return to cycling and running; those are his goals. The first thing toward reaching for that... return to running and walking without the device and all that is to maybe think about increasing his gait speed. I wanted to share with you some things that I did to increase his gait speed, besides just telling him to walk faster. We would walk, we'd be outside, I saw this person in his home. We'd be outside on the street, we'd walk some certain distance that I just sorta eyeballed in my mind. I didn't measure it or anything. But I would time

how long it took him to walk some set distance, 30 feet or something like that, let's say and I would time him. And I'd be like, okay, that took you, you know, however many seconds it took you. How much faster can you do the next trial? We're gonna do this several times, how much faster can you do the next one? And he'd say: Well, I think I can go maybe 10 seconds faster or 20 seconds faster, whatever. I would time him. I've done this over and over with lots of patients. Probably for at least two or three different iterations, they're going to be able to meet their goal of going faster, when they set the goal. I would get him going faster by giving him information about the speed that he was already going, and by saying: How much faster can you go? I'm setting an expectancy that he'll be able to go faster, so those are some of the things that I utilized to change his gait speed. Everything we did was very targeted towards running and cycling, so we started off on an elliptical in his home. That was the thing that we chose to start with because it's very similar to walking and running. Safe for him to get high repetitions of activity going there and it was very motivating for him. We moved to being able to ride his bike on a trainer.

We moved from that to being able to ride a three-wheel bike. All of those things, they were all ways to work on lots of different things that I had for him, but they were all very focused, very goal-oriented for him. In terms of this patient was very much focused on, again, figuring out what that challenge point was and constantly moving that challenge point to higher and higher challenges. Used a lot of external focus in everything that we did, whether it was upper extremity work or lower extremity work. We did a lot of hitting targets when we were walking and stepping, again, rather than having him, giving him feedback about how to move his leg. Did a lot of Trying to do things more automatically. So, having him do things that caused a balance reaction rather than me trying to get him to have ankle movement or hip movement in a certain way, I would put him in activities that would demand that based on the balance reactions that were necessary. So, just some examples of kind of, patient focus, external focus, intensity, some of the things that I worked on with this patient which were really successful.

Felicia asked: What are examples of external cues for foot placement? You know, I do targets on the floor, but the key here is that you have them walk for a certain amount of time with targets on the floor, but then you have to have them look up and try to still hit the targets without looking down. Because I don't want the patient walking and looking down all the time. That would be one of my suggestions there. I also do a lot of stuff with a metronome. And that's not so much for foot placement, but if they're stepping on the beat, that typically is gonna increase or decrease their step length in the way that I want them to. I'm being told that we are out of time.

I know that we are a couple minutes over. If there are questions, and you have my email address here as well, but if there are questions? It looks there's a question for you guys, Kathleen or Jessica there. It says: Questions for the host. What would be the answer to number eight? I would have to open up the quiz in order to tell you. Can you ask me a question rather than just the, the number? That'd be helpful. You're welcome. There was a question for you guys, Kathleen. Is there a list of course participant names? That was Christine Reyes. Oh, here's the question number eight: Explain the link between motivational manipulation and modulation of motor learning. A positive affect is linked to dopamine processing. A negative affect may increase motor processing.

Okay, rather than just tell ya the answer to this, can you tell me, what's your specific question? Have you eliminated any of the answer choices rather than just? What's the question to number eight, answer to number eight? This is asking about the link between motivational manipulation and modulation of motor learning. You've eliminated A. Or you think A is the answer? It was A or C. So, C is positive affect may increase need for reallocation of attentional resources to self-regulatory efforts. That's not correct. It's not positive affect. Remember, positive affect is more about external links to external focus, more automaticity. Yes, so A is correct, yes. Yep. Any other questions?

- [Jessica] Okay, well, thank you so much, Jill. We really appreciate you sharing your expertise with us, and this wonderful information. Thank you, everyone for attending today's e-learning course. This does conclude today's course. Please join us again for future courses on [www.physicaltherapy.com](http://www.physicaltherapy.com). Make sure you like our Facebook page and follow us on Twitter for our latest courses. You can also see a list of upcoming live courses on the Physical Therapy website. Enjoy the rest of your day, everyone.

- [Jill] Thanks, guys!