Applications in Dual Task Rehabilitation From High Tech to Low: Covering the Range for All Treatment Settings

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-[Calista] Today's title is Applications and Dual Task Rehabilitation from High Tech to Low, Covering the Range for All Treatment Settings. And it is my pleasure to once again, welcome back Mike Studer of physicaltherapy.com. Mike is the owner and lead therapist at Northwest Rehabilitation Associates, a chamber member, in active presence in the Salem community, he has been a PT since 1991 and a clinical specialist in neurologic physical therapy since 1995. Mike is the only therapist in the nation to be awarded the Clinician of the Year by two different national academies of the APTA, being award, the Clinical Excellence Award in both neurology and geriatrics. He has authored over 30 journal articles and contributed to our primary authored six book chapters. He is a recognized national international speaker on topics including aging, stroke, motor learning, motivation and rehabilitation, cognition, balance, dizziness, and Parkinson's disease having presented in 48 states and nine countries. In 2020, Mike presented a TED talk on neuroplasticity that has been viewed by thousands and he was awarded the highest honor that can be bestowed on a physical therapist. One of only 250 therapists in the nation to be designated a Fellow of the APTA for a lifetime and diverse contributions to the profession in clinical research and educational fields. So welcome back, Mike. We are so pleased to have you here with us this evening. And at this time I'm gonna turn the microphone over to you.

- [Mike] Thank you so much Calista, and I wanna thank everyone at PhysicalTherapy.com and Continued, you guys do a fabulous job of helping me look good in the productions here and all of the behind the scenes efforts that you provide. So thank you so much. And also, thank you to the attendees for your participation today. I see that we've got a very large number of you already online, and if you're listening to this in recording, I will equally welcome you right now. Let's get down to business and find out about these applications and dual task rehabilitation, a main and significant area of passion for me in the last 30 years of my clinical care. So, as Calista

mentioned I've got some background clinically here but what I don't have or any financial incentives that I'm bringing to you today, I'm not going to push any products to you, I don't have any financial incentives to have you follow what I'm doing or purchase what I am using in the clinic. So no disclosures whatsoever. Next, I want to make certain that all of you are familiar with the learning outcomes as a portion of achieving your, and being granted your continuing education units I need to read these outcomes to you. After reading these to you, I won't read any more slides to you whatsoever I'm not a presenter that will typically just bore you by reading slides to you. So, as a result of this course, participants will be able to, three things, identify the comprehensive responsibilities in testing dual task tolerance in all four modalities cognitive, visual, auditory, and manual distractions. Identify and actualize the application of dual task training to achieve automaticity, procedural memory and function without commanding all attentional resources and identify the health consequences of dual task intolerance and function.

With all of that said, I want to have you watch for the green messaging, the green font along the way, because that's where you might find some information that will be helpful to you in your post course questions. So, who am I? And there's a little bit about me. I'm not going to spend any time on this slide. I just wanna make sure you understand where I'm coming from, what my capacities and capabilities are, and also what I'm not going to be covering today.

We have about two hours of time to work together. There are things that I've chosen not to cover as a function of that time so that I can comprehensively cover the other important matters of applications for you. So you can see what we won't be covering but I am certainly available for your contacts after the course. So if you can project any questions at today's offering or by email afterwards, I'm happy to continue the educational offerings to you. So let's start off and get on the same page. Let's take the most widely accepted definition of dual tasking by McIsaac and Plummer in 2016 and

that is, as bolded at the top of your slide really the concurrent performance of two tasks. It's not, as you see down at the bottom making a single task more complex. It doesn't mean caring cup of water or a backpack on your back is dual tasking. It just means that's a more complex procedure of the single task of walking. Now, take for example, if you were to take a backpack off while you're walking and open it up while you continue walking, retrieve something out of that backpack, that's dual tasking. But carrying that backpack on your back or in your hands is a complex form of single task walking. We'll get into that a little bit more, but let's keep in mind what does and does not comprise or constitute a dual task.

So, as you see, that's printed for you in green and I wanna make sure you're calling that to your attention so that you can be more successful in your questions later on. Now, these are the highlighted points that will also be instrumental for you to be successful in the test and I won't repeat those to you. You can see exactly what that makes, what is that is made of, all right. So, attention is not the same thing as dual tasking. There are four different and by some opinions, five different parameters within attention. One of those is included in dual tasking.

So selective attention means, I have a very busy world here in front of me, what I'm going to focus on is this. Divided attention is dual tasking. Being able to simultaneously offer some of your attentional resources in two or more different directions. Dual being two, divided attention or multitasking meaning more than two. Alternating attention means you're not dual tasking. It means you are attending to one stimulus, one activity, one task, and then at the sacrifice of another, you switch. So I'm either paying attention to changing the radio in my car or paying attention to the lane that I'm in. Paying attention to the kids in the backseat, or paying attention to the car in front of me. That would be alternating attention and obviously in both of those scenarios it would be preferable to either have divided or selective. But alternating attention means you've shut off one stimuli while paying attention to another. Now, completely contrasted to

that is sustained attention. Sustained attention is, your duration of being able to attend. So attention has all four of those parameters, dual tasking is merely one of them. Let's get into Chapter 1 now that we've made some definitions here. The consequences of dual task intolerance can mean falls. And that's probably one of the most prevalent arguments for why we need to test, train, and investigate in research, dual task capacities. So, we know that Plummer in 2016 wrote the dual tasking is widely recognized as a fall risk. But we also know that dual tasking requires neurophysiologic activity in the brain that is very similar to constraint use movement therapy, it's just that in dual tasking, we're constraining the attention away from the user so that they're forced to use some areas of the brain that process tasks automatically. And if that doesn't make 100% sense to you already, that's okay, you're gonna learn something today.

So, what different activities in our daily lives require dual tasking? Well, if you are feeling pressure to get to the restroom quickly, to get to the phone quickly, to get to the door while someone's there ringing or knocking quickly, you have urgency. You have a cognitive distraction. And to be able to tolerate mobility with pressure or urgency, is dual tasking. Being able to move around obstacles that are in motion, being able to negotiate pedestrian traffic, automobile traffic, grandchildren, or dogs, that's examples of dual tasking in mobility.

In addition, as you see in the photo on your lower right hand side it could be well considered that dual tasking during mobility could be trying to dial a cordless or a cell phone while you're walking as well. Thousands of other examples are bound, let's move forward. Dual tasking occurs in ADLs as well, doesn't it? And so, that means, when you are attempting to sit at the edge of the bed and get dressed or when you were attempting to brush your teeth and maybe also check your appearance in the mirror, you might be working on trying to apply makeup with one hand and brush your teeth with another. Keep in mind that dual tasking can also be complicated by

sensations, pain, fear of falling and the ability to be able to just merely keep your balance while dressing can be loaded with pain or fear and can interfere with an individual's ability to concentrate on the primary task at hand. Dual tasking has some common threads in the realms of procedural memories. Meaning, if you have an underlying habitual movement one that is proceduralized or one that can be said to be automatized that means that's a task that you have done with enough repetitions and enough frequency that your brain doesn't need to think about it so much because of the degree of familiarity you have. And so that could mean driving a car, shifting gears in a five speed car, buttoning a shirt, shooting a basketball, or brushing your teeth, all of those as well as hundreds of other activities that you can do in a sporting life or in your daily world could be ascribed to procedural memories if you have enough frequency of exposures but you know what, it's not just repetitions. Repetitions don't just cause an individual to have stored an activity as a procedural memory, you need to do have forced the brain to pay attention elsewhere during some of the times you've had those repetitions.

So that means, having to stand on one leg, adjust a shoelace, look at your appearance in the mirror while you're brushing your teeth caused your brain to continue the toothbrushing activity without full attention. So it is yes, repetitions, but it is also the pure demand of having thinking or doing something else while simultaneously, remember the definition of dual tasking, while simultaneously carrying out the other concurrent task that will give your brain the opportunity to store those down in a procedural memory center. Now you must be asking yourself, where is this procedural memory center? Well, now I'm going to show you where the primary procedural memory center is in the brain, is the basal ganglia. Right there on your slide, the primary but not the only procedural memory center is here annotated by BG in your slide. In addition, I want you to be aware that the main attention center is called out on your slide and that's the DLPFC. Don't worry, we'll get to what that stands for in a moment you'll see that in your slide and you'll get to learn it so you know for your test

upcoming how to answer that question. What's important right now is that your main attention center is the DLPFC. It responds and lights up when we are working toward achieving a goal. It's more lit up when a patient, an athlete, you, a consumer, a trainer, anyone, a student of music, is working toward a goal rather than move like this, because I'm asking you to move like this. So, movement-based representations, don't snap your knee back set your heel down first. Don't swing your leg out to the side will not induce more activity in the dorsolateral prefrontal cortex, the DLPFC. However, goal-based representations will. Now, there are four different centers for procedural memory storage. The main one is the basal ganglia, you are probably already thinking about where some of the other ones are.

What's important right now is that we get a chance to apply with our patients, the evidence. When you have a chance to call to their attention what they should be doing, let's collect our goals, our advice, and our cues, around goal-based rather than movement-based information. That'll become clear for you as well. Here we go. It's in green. You know you're gonna watch for it because of your test the DLPFC is the dorsolateral prefrontal cortex. I think I've given you a good enough hint to watch out for there. So, if I'm working with a patient who is recovering after stroke, incomplete spinal cord injury, has multiple sclerosis, any one of those, I could give them movement-based representative cues and as I suggested earlier, but I'll add a few more don't hike your hip up so high. You're lifting your pelvis on that side. Don't lean your body fully over here.

That's going to increase their activity in the motor cortex and the motor strip or the homonculus, however you want to refer to that. That's likely to be where their lesion was though. Likely to be the reason that they have full acidity in the first place. So I'm going to encourage you not to direct your cues here but to direct your cues around the goal. As we move ahead, I want you to try to step over the threshold of the doorway. I would like you to try to keep your feet within the pathway of these tape lines that I've

put out. I want you to try to see if you can use the backside of your shoe to come in contact with the floor first. We do externally-based references toward the environment not the body, to be maximizing the procedural memories and to reautomatize things for your patients. So remember, procedural memories are actually stored in the brain and we want to avoid hewing toward where the stroke has damaged the brain. So we want to try to respect and realize that in many of your patients their procedural memory centers are preserved. So keep this in mind. When we dual task with patients, we cause them to drive some of the movement back down to the procedural memory centers and that movement emerges a little bit better because that part of your brain remembers how to move, remembers how to get out of bed, remembers how to climb the stairs.

So keep these things in mind when we're talking about dual task rehab in stroke and also, let's extend that into Parkinson's disease. How many of you are familiar with the concept that many people, not everyone with Parkinson's disease actually climb stairs better than they can walk forward. Keep that one in mind, as you're thinking about storage of a task. So why is this important after a stroke, after spinal cord injury, even after a concussion and after a lesion or an exacerbation of MS? Well, we all know that if you're dependent on attention and you need 100% of your attention focused in on your walking that as soon as your environment becomes complicated, complex, commands, or demands a little bit of your attention, you don't have 100% of attention on the task at hand anymore.

So that means, whatever you're doing as a primary task, walking, swallowing, dressing, speaking in public, any one of those things the more or greater amount of your attention that those things require, the more at risk you are for faltering when you get distracted. So, if you don't distract your patient in therapy and you're not doing so intentionally with some dosage, that means when they do face distractions out in their real world, they are at risk. So keeping in mind, we don't want tasks to be frontal. We

don't want them to require a great deal of conscious attention because they didn't before the stroke, they didn't before the spinal cord injury, they didn't before the MS exacerbation. And you're putting your patients at risk, if they don't experience exposure to distractions so that they can normalize and automatize. So, as I've already said to you, and now I'm highlighting for you in green because it might be on your test this is one main reason why dual tasking is important just for the example of stroke. So, let's move on past stroke though. Why is dual tasking important in Parkinson's disease? Well, yeah, for a lot of the same reasons that I listed for you for stroke but now here's another big one that you might not be in, been aware of and that's four bullet points down and in green because it might be on your test and that is the DLPFC and I'm sure many of you now know what that stands for the dorsal lateral prefrontal cortex is likely going to be dopaminergic either in total or as a majority for every one of your patients. There are some personality-based differences here and some individual differences that I'm not gonna say, everyone's DLPFC is entirely dopaminergic-driven but for the most part, this is the case.

So, now consider what that means. When the substantia nigra is not delivering dopamine to the basal ganglia, people with Parkinson's disease have what appears to be a primary motor disorder difficulty creating force, difficulty initiating movement, difficulty starting one task and stopping another. And then continuing. Again, difficulty handling some visual distractions and difficulty with dividing attention. The dividing attention part is because the DLPFC requires the same dopamine from the same source. So when your patient with Parkinson's disease is walking across the room and is having difficulty walking, turning, and then coming to a chair and sitting down, let me suggest to you, don't ask them to crash two tasks together, ask them to walk to, especially if they're severely impaired ask them to walk to the chair for a different reason. Hey, can you go peek out to the window there and see what the weather looks like right now? And once they're at the chair, then have them. Once they have stopped walking then begin the task of turning around. Dividing those tasks out temporarily, is

very helpful for people that are severely impaired in the main attention center and the main procedural memory center. So now let's go again. Why is this important at a different diagnosis? How about multiple sclerosis? Well, imagine three bullet points down, just the amount of duress that fear of falling consumes in your patients. Remember if you have a finite amount of attention, and you're spending some of it on where your dog went, what toys are left out in the home, how much your right leg hurts right now, whether or not you have your brace on, and if you are catching your foot like you did four steps ago, but now you're also consuming some of your attention on the psychological consequence of being fearful and falling. You only have so much attention to pay out. Your attentional resources are finite. So if your patient with multiple sclerosis is additionally fearful of falling, that's going to consume more of their attention than not. And how about concussion?

Well, the first two points obviously, relevant in concussion and the green point in the middle, relevant for concussion and relevant for the test that you're about ready to take. After a concussion, people have less capacity to be able to deal with higher intensities or even normal intensities of different sensory modalities. Sound, light, motion, cause cognitive distractions and fatigue. Now, why are persons that are recovering from concussion less tolerant of distractions? Primarily, this happens because attention is a very broad and widely distributed network throughout the brain. And what happens in concussion?

It's not merely that the DLPFC is always injured. What happens is, the network of white matter that connects the DLPFC to the visual center to the perceptual lobe, to the vestibular cortex, and yes, there is such a thing as the vestibular cortex. The attention centers are widely distributed. And what happens in concussion? We have diffuse axonal shearing, diffuse axonal injury, often abbreviated DAI. That means the networking, the white matter is disrupted and connections that were high level allowing for very integrative processes and very expedient high speed decision-making are no

longer available. And we're belabored by the sensory stimuli. We get fatigued. We get distracted easily after a concussion. We're ready to move on to Chapter 2. Chapter 2 helps us understand how to educate our patients. The DLPFC, as I've suggested to you, receives dopaminergic substantial nigra projections to its location in the frontal lobe. Which impairs all of those bullet points that I've got on the right hand side of the column there. Impairment in the DLPFC puts more responsibilities on the basal ganglia, puts more responsibilities on the centers of automaticity when we don't have enough attention or resources to pay attention entirely to the motor task at hand.

So when the DLPFC coordinates with the primary motor centers of procedural memory, and now I've got all of them listed for you, the procedural memory centers, basal ganglia, supplementary motor cortex, or supplementary motor area either way, cerebellum and the premotor cortex. We understand that is important for you to answer in your test upcoming but we understand that these two centers corroborate, they collaborate and they go back and forth to decide, are you gonna pay attention to the walking? Okay, you take care of that and I'll pay attention to where the automobiles are where the cracks in the sidewalk are or where it looks icy.

And all of these co-ordinations occur together on top of the histrionics of how I did with this task. For example, walking outdoors on a sidewalk when it's icy, the last time I had to do it. So emotion, some fear of walking on ice, psychology, some recollection of where I had a car accident and some autonomics that occur with fight or flight when that's called in to play as well. So, you see this as a very green slot I want you to be very familiar with this content so you can be most well-prepared for your examination. Meaning the physiology and function of improving task tolerance, this is very very important. That means, neuroplasticity happens when we expose persons to dual tasking. And the eventual outcome can be for patients that are capable to make learning-based changes, neuroplastic-based changes is that they can become more automatized, more proceduralized, more capable of operating movement in the

background. The second thing that happens. Patients become aware of the pitfalls and risks of engaging in a distracting environment. So awareness has improved. In addition, people that are exposed to distractions on a regular basis become tolerant through what we call habituation. That means a reduction in the amplitude of an action potential because of subsequent and frequent and repetitive exposure, habituation. You know that term because of vestibular rehabilitation. And I'm introducing the concept to you in neuroplasticity, meaning, if you introduce and engage your patients in some dual task exposure they're going to be more tolerant of it in time and comparison to a patient that's never been exposed to dual tasking.

So in addition, we have patients that become adaptable because of the different varieties of exposures you've given them and finally, patients learn how to decision make. They learn how to prioritize, and they learn how to compensate through selective attention. Now, dual task actually improves learning in your patients that have sustained a stroke and that's cited in this article from Winningham and Studer in 2017.

Meaning that drawing a patient's attention away and encouraging the brain to reproceduralize is actually a contributive portion of rehabilitation and recovery post-stroke. The consequence is very harmful. Allowing or even encouraging patients to pay full attention on the motor activities. Watch how your leg moves. Don't let it do this. Watch how your arm moves, make sure it goes here. That's the contrast of reproceduralizing and reautomatizing your patient that's capable of doing that again because that area of the brain is intact. So I'm not gonna go over this slide. We're going to go into each one of these things as we progress in retraining procedural memories and the applications, okay? So the neuroplasticity that happens in dual tasking requires habituation, awareness, new growth and automaticity. So we've talked a little bit about that and I want you all to expect your patients to improve in one or all five of these parameters. I want you to also understand that not everyone is going to improve in dual tasking not everyone is going to improve dramatically and we have to

use our science in dual tasking and our screening in dual tasking to be able to apply the dosage economically. So, are your patients actually improving in their primary task, might be ready for some dual tasking? Have you made a dual task setup that's very task specific something that not only seems real world but also seems relevant to your patient. When you engage in dual tasking, are you considering the amount of error that this person is tolerant of? And then finally, how is your patient doing in terms of gaining awareness? Now, we compliment that in obviously with intensity and novelty in terms of relative experience, but all of these things are plausible in dual tasking. And as I've suggested, what is the outcome of having worked in dual tasking with your patients? The outcome is automaticity.

Patients that can move with movement in the background. So with that said, let's continue to look forward at the applications. We want our patients to have automaticity of walking, not just for a level-carpeted surface in the home, but also automaticity of walking when the surfaces are a little bit irregular, uneven, or even have some undulations. We want automaticity in ALDs. So that you can proficiently brush your teeth completely even well, as you see here, you're maybe listening to a podcast. You see, he's got a little wires coming there. He's actually got a little, a head piece in his right ear there. So you wanna have automaticity in ADLs.

And here's another consideration for you. How about automaticity in avocation? So this lady right here, is she going to be able to tell a story about the fabric that she is weaving, about the garment that she's creating while she is additionally continuing the operation with both of her hands? Absolutely. How do you get to that level of automaticity? By looking down at your hands full time and concentrating only on that and not engaging with the world around? No. By challenging yourself to handle both. So the principals and the tenets of dual task rehabilitation, before we get ready to look at so many videos and examples of exactly how to carry this out are listed for you here. As I've suggested to you, we need intensity. We need to have some cognitive reserve.

We need to have task specificity. And you know what? We need to actually consider the personality of the patient ahead of you. The patient that has experience in soccer. Experience as a worker on an assembly line. A desire to do farming and gardening again. You structure your dual task around your patients' interests. So the hierarchy of modalities and the consideration of the types and subtypes of distractions that you wanna introduce should actually be considered of the individual in front of you as well. Because in fact, I'm asking you a rhetorical question right here. There actually are no hierarchy of modalities. That's right. All four different modalities of distraction, cognitive, visual, auditory, and manual has no greater relevance for any one person than the next. Some people can handle visual distractions and not have a problem doing their homework. Some people can't.

Others, auditory distractions will destroy their ability to take a test or learn new information visually but others can handle playing music in their headphones while they're studying. And the same is true for cognitive and manual. So, unless we test and unless we screen, we don't know. So, we have to consider the actual, virtual and virtuous cycle that is available for us in rehabilitation as we're working with our patients. So it doesn't matter, cognitive, visual, auditory or manual distraction until we find out what matters for this person.

So I'm gonna take you through this virtuous cycle and give you some examples as we go along the way. Primary task in the upper left hand of your figure. Primary task, insert whatever you want to here. Swallowing, meal preparation, dressing, brushing your teeth any form of ADL, IADL, light hygiene, walking, getting out of bed, sit-to-stand, whatever the case may be. If you have a primary task that has some procedural attributes you can infuse and load the patient or client with a secondary task. That secondary task can have any one of four different modalities, cognitive, visual, auditory, manual. But before you do that, I'm going to encourage you to warn your patient ahead of time, to expect a reduction in performance. What happens when you

warn that patient to expect that their performance will go down? That patient is prepared to have a few more losses of balance, prepared to miss a button, prepared to have to clear their throat, sitting at the dining room table, prepared to maybe miss a break in the setup for their wheelchair. As you give them the distracting stimuli patients will habituate, right? Improve tolerance to stimuli with repeated exposure. And what else happens? As patients have to learn how to deal with the presence of a distraction while continuing to operate a primary task as long as they know that their accountability is being reduced, that we expect a reduction in performance they will then subsequently experience an improvement in the automaticity of the primary task.

Now, what happens if you don't tell your patient to expect a reduction in performance? Two things. Number one, they kept their level of performance up and they're not dashed. Number two, their performance did falter you didn't warn them that it was going to and they feel that they have let you down they've let theirselves down or that they're getting worse through some other dynamic that's not happening. Now, what actually happens when you do let your patients know ahead of time that they should expect a reduction? Two things.

Number one, their performance goes down and they're not surprised, they're not dashed, depressed, or starting to criticize or question themselves. The other outcome, patient's performance is either at level with what they had performed, with no distractions or they actually improve. They concentrate so much, shut out the distractions or handle both of them together and they perform nicely, exceeding your stated expectations they are elated. You like that. That's a dopamine reward cycle. That's a patient who has some neuroplasticity. That's how we improve in dual tasking. So let's summarize to this point, what you have learned. And I'm gonna let you read these six bullet points. I'm gonna let you read them in silence. And now at this point, we're ready to move on to Chapter 3. We're gonna take a look at interventions. We're gonna look at applications in gait, and you know what? I'm gonna tell you that more

than 75% of the applications we're gonna look at here, not only apply to gait but additionally, apply to other real world functions. And I'm gonna show you them, many of them in walking and then I'm gonna surprise you with a couple as well. All right. So first off, we're gonna take a look at the consideration of body weight support. I'm gonna tell you that most of the videos you're going to see patients under the protection of body weight supported treadmill training primarily because I can raise the bar. I can challenge them harder. I can keep them honest with a walking speed because the treadmill doesn't allow them to slow down and speed up, as their processing is being interfered with. So it increases that accountability. Keeping in mind additionally, that treadmill training allows for a greater number of repetitions, changes of direction, speed can be elevated beyond what the patient is self-selecting and so many other reasons.

Now, if you do not have body weight supported treadmill training available to you I want you to understand that any one of the things, every single one of the things that I'm doing today can be carried out on level ground if you have a way of keeping your patients safe. Now, I'm gonna show you some high tech and I'm gonna show you some low tech and I wanna feel your questions if you have any, questions of how to apply it outside of the parameters of what I'm describing.

So I'm gonna play a video for you momentarily, and I want you to see, you're not going to need to listen to anything you're gonna watch this patient recovering from right-sided stroke, right body affected. We're gonna watch her while she's trying to keep a degree of symmetry left step and right step while she's trying to keep that up as she super imposes, eyes closed then she opens her eyes back up and you're gonna watch her do a manual distraction and then you're gonna watch her do a visual distraction and then you're gonna watch her as she does a cognitive distraction. And I want you to watch, to see how her walking changes, if you would please. So Julia, let's go ahead and play the first video and I'll cue that right now. Remember, right-sided

impairment. Don't worry about the audio. Just watch her symmetry of walking. There's a metronome playing in the background right now and she's trying to drive her steps in accordance with that metronome. And right now she's shifted into eyes closed walking. And she's just trying to keep that up 'cause remember, the treadmill keeps her accountable and keeps her honest. Now, you're gonna watch momentarily, she's gonna shift into a manual task distraction. She's actually lifting her left hand up, drawing a toothbrush out of a case, that's her toothbrush that she brought from home because I asked her to, she's pulling it out with her right hand and brushing her teeth with her more impaired non-dominant, this is a left-handed individual, right hand. And we wanted, that's why I shot over to the video there so you could actually see what she's doing and you wanna look at her legs to see, is that affecting her ability to walk and keep up symmetry or not.

That's one way of screening and investigating your patient tolerance. Now, she's gonna put the manual distraction away and she's going to start to look at the image, the photo in the upper left hand portion of the book that we've placed in the front console of the treadmill. And right now, she's telling me about what she sees in the photo, visual distraction and one can argue additionally, cognitive distraction. Now after that, she's going to shift over to the right hand page and attempt to read the words in the right hand page.

Again inarguably, cognitive distraction, arguably, visual as well. And you'll watch how she is becoming much more asymmetric right there toward the end of her walking efforts specifically with the cognitive distraction load. Now, why would I do something like that with this individual? Her job is to walk around in the classrooms or in the hallways of a school, she's gotta read from a list takes supplies from classroom to classroom. She's gotta hold the clipboard. She's gotta be able to sort what she needs to do next and where she needs to go next and what she needs to take where. We're trying to make it as task specific as possible. So, we're gonna move back to your

slides, take a look at the next case example and we're going to be introduced to John. John had a stroke about 20 months before we cut this video I started seeing him about 18 months after his stroke. I want you to understand the video we're gonna watch for John is very task specific, very interesting to him. And I'm not going to blow or steal the thunder right now I want you to watch that, but I want you to consider, we're timing the introduction of dual tasking because he's ready for it. He's got awareness of the effect of dual tasking. He's got awareness to what his gait deviations are. He's currently improving in the single task of walking and he's got a personality tolerance that will allow me to challenge him a little bit without dashing his hopes. He has a desire to achieve this very task in dual tasking and this is very practical for him. So let's watch in for his video now.

And as you see, he's unfolding a newspaper. Isn't he? He's unfolding the sports page. He's going to start to read from the top 25 list of college basketball teams and he's gonna have to tell me who's number one right now, he's gonna have to tell me who's number six in the nation right now, but he's gonna have to simultaneously keep up that quality of walking that he knows how to monitor. Now, he's gonna fold that newspaper back up, put it back away, we did a visual, a cognitive, and a manual task altogether there. As you may or may not be able to detect, his right hand and the entirety of his right arm are quite impaired as well.

Let's go back to your PowerPoint and we're gonna look at the next slide. We're gonna do yet another introduction of an application in dual tasking. We have a patient here who's quite a socialite who needs to be able to keep her walking up while she's gone out shopping with her friends and she takes a drink from a cup of water or a soda or a pop, or however you wanna refer to it across the nation here. And you wanna watch to see what happens to her walking when she simply introduces that secondary manual task. Remember, all five of those points are the same ones that you just saw on the last slide. But awareness is probably the most critical one that we're witnessing here. Let's

watch her video now. Now, you'll see some of dialogue in closed captioning down at the bottom of this one. I'm encouraging her to go ahead and reach out, grab the soda, pick up the drink and drink out of the straw. This is very important to her life to be social, to be active, to be capable. All right, well, fortunately she was assisted a little bit by body weight support there and had the side rails of the treadmill available. Now watch as she does it again, she will completely come to a stop in walking because she's so focused on taking that drink. And the capacity to divide attention for a person with a right hemisphere stroke and left involvement is sometimes quite impaired. Look at that. And fortunately, she's smiling. She knows this is important for her and she's engaged in doing that.

All right, we're gonna pull back to your handouts again and we're gonna go to the next case example. And we're gonna watch a patient who needs to be able to walk her dog a slightly disobedient dog one that she has to pay attention to and she has to divide her attention between. And this dog is being pulled along while she's walking on the treadmill. Let's watch that video now. Now, in fact, while she's doing this setup, we didn't bring the dog in, we use a therapy cord. And we simulated that therapy cord for her, you could do this on level ground, she has to pull the doubled therapy cord there, pull it along like she's trying to keep her dog moving on a walk and not stopping to take yet another break.

And that was functional for her, and real world for her and important for her. Let's go back to your handouts again. So, we understand with what we've seen so far that there are different applications that are practical and reasonable in walking. What I'm doing for you now, is giving you a couple of main theories and main application slides so that you can be ready to apply these right out in the clinic on Tuesday, I'm sorry, on Wednesday morning. The first main slide that I've given you here is, dual task training in gait, manual ideas. And a couple of slides from now, you're gonna see cognitive and then three slides from now, you're gonna see auditory and four slides from now, you're

gonna see visual. I want you to capture these four slides. I want you to take an opportunity to study them after the course. I don't wanna read these to you now. What I am trying to hand to you here, is something that a lot of therapists have asked for. Just give me some practical examples for what I can do with my patients at home or in the clinic that are dual task relevant and that are task specific. All right. So, dual task training in gait. Things to do when patients are being introduced with manual distractions. And now let's take a look at one of those right now. In the next video, a patient who's recovering from brain injury.

- Good, so you reversed your direction because it was a red card, red reversed. Good reverse you direction again, red card.

- Every time she pulls up a red card she's supposed to reverse her direction.

- Black card, what do you do?

- I'm sorry?

- If she pulls up a...

- Just keep going. The black card, you keep going in whatever direction you were going which was backwards.

- Okay.

- A black card, she does not change her direction of motion.

- Keep going. It's a black card, make your decisions fast.

- Okay.

- Good. She did it. Red card reverse. Good, black card continues on.

- You made the right decision. Continue going forward. A black card is, basically ignore it.

- And black card, look at her going now, she's continuing. Good, and we're going to go ahead and slide back to your PowerPoints now. That's a great exemplification of something easy to do. It was practical for her, she loves playing cards she wanted to be challenged, this lady is two years after brain injury and want something to help her become sophisticated again. She used to run her own, privately operated independently owned social work business. This lady had all of the attributes going for her. She was an entrepreneur. She could communicate with people. She wants to be there again. She wants to be challenged. So, personality is allowing me to challenge her and evidence tells me I'm must. So this was slide number two of the four that I wanted you to watch out for. This is, what if you want to challenge your patient with cognitive distractions.

And this is a nice list of those items. You don't need me to read those to you. I told you, following that was gonna be a list of auditory stimuli. Remember, this is not a comprehensive list. We've got enough time for me to give an introduction to you and I can certainly be tasked for more, where you're to email me or to just engage with me about a case or a patient that you like to have some problem solving help with. And then finally, this is the fourth of four slides. This is the gait training visual slide to look at some applications that are viable for you. I want you to additionally keep in mind that even though I put gait training on all of these, like I was telling you earlier, many of these secondary distractors can also be incorporated for ADLs and other aspects of mobility-related ADLs. So let's keep moving forward and let's keep in mind that when it

comes to dosage, when it comes to intensity, when it comes to challenging your patients, keeping in mind that as long as you're operating within the parameters that I've provided so far, patient has potential to improve single task. Patient has personality tolerance to be distracted. Those are the main two principles that you need to follow in order to always push the envelope and to challenge the patient so that the brain supplies more capable, more capacity, more neuroplastic connections. The brain only improves in the face of demands. That's right. We're talking about neuroplasticity being demand and supply. So what kind of dosage are we looking for? Well, for the most part, we're looking for about a 70% success rate. You want your patients to be challenged but you want them to feel that they have succeeded about 70% of the time that they took seven steps before they had a small pathway deviation or a loss of balance, that they were able to complete seven different steps of a sequence before they forgot one step.

So, about 70% success rate. And that can mean seven out of 10 sit-to-stand repetitions. But three out of the 10 need to involve some faltering, some loss of balance, some cues, because if the patients are too successful, they may feel pandered toward and the brain may not receive that supply I just talked about, or rather the demand that I just talked about so therefore, the brain will not receive the supply that we referred to.

So if you're not demanding enough, and you allow them to be 100% of the time, successful don't expect any supply, change or improvement. Now, everyone has a different personality going in. Some people need more than 70% success rate. Some people need less. That's up to you to read the personality of your patient. And I believe that this slide exemplifies exactly that. And I'll only elaborate by saying, the reason why we want to have demand and error and a few repetitions that are not purely successful, is that the patients can be challenged and that when they are successful, they feel that they have accomplished something rewarding. The dopamine reward cycle is

facilitatory for learning. All right, so now we move forward. And I give you yet another application slide. I don't want you to read from left to right on this slide and think that all of these are lined up. What I would prefer that you do is select from a mobility item in the left hand column. Combine it with a manual item in the middle column, or not both, combine it with a cognitive item in the right hand column. So for example, if you're gonna have your patient walking on uneven surfaces, maybe they're doing that while they're buttoning a shirt, or maybe they're doing it while they're holding a conversation with you and keeping eye contact with you. So you have options that you can choose throughout the table. You do not need to operate left to right. And we are ready for Chapter 4. Chapter 4, we're gonna cover the interventions for dual tasking. And we're gonna look not at applications in gait, we're gonna look at applications in ADLs and balance, function and fitness.

So let's start with ADLs now, and let's look at ADL independence, which is ultimately dependent on your ability to be able to carry out a task by yourself. Remember the steps, do so within the timeframe that's reasonable and with the energy expenditure that you have.

So therefore, if you're so distractible and cannot stay focused that it takes you 25 minutes to put a shirt on you may actually be physically independent but may not be able to carry that task out independently because of the amount of time that it consumes out of your day, you become dysfunctional. So, people need to be able to concentrate, they need to be able to tolerate distractions, and then you'd be able to carry out more than just the physical attributes of ADLs or hygiene completion or IADLs and procedural memories. And we could add on to this, looking at combining instrumental ADLs and procedural memories on top of walking, retrieving a payment, keys, kleenex, or glasses out of a purse, or maybe a driver's license out of a wallet. These types of things should be overlearned. They should be automatized for you. Imagine how many of you and how many thousands of times each one of you have all

already in your lives, no matter how old you are, have walked within your home and pulled something out of a backpack, a purse or a wallet, while you continue to walk. Have cleaned your glasses or brushed your hair or brushed your teeth, while you've continued to walk. Think about the automatic nature and the commonality, the obligatory nature of dual tasks that happens so many times throughout our lives and however I have to ask you, are you challenging your patients to do the same? Now, remember IADL by definition will require a little bit more cognitive input, attention to detail, accuracy, whether you're talking about calculations, multitasking, sequencing for a multistep process, and it's great to have pushed your patients toward IADL capacities so that they are also capable when they face those out in the real world. So now, this should look like a very familiar slide to you but now we're giving you practical examples for it.

So if dressing is the primary task, and you have to simultaneously remember what appointments you have today and what items you need to get from the grocery store on your list and your patient, your client, your grandmother is expecting a reduction in performance, maybe the time it takes her to get dressed, maybe the cues that she needs, maybe the accuracy that she achieves, if she's expecting a reduction she's not going to be so deflated when that occurs.

With regular exposure, your patients are going to be more tolerant to these distractions that are simultaneously imposed. Remember, concurrent tasks was the definition by Plummer and McIsaac, and as they have been pushed and encouraged and exposed to dual tasking, that patient becomes better at the primary task, better at tolerating distractions, more aware and resumes automated performance similar to how they did before that illness, that stroke, or that exacerbation with MS. Now, just like the gait table that I shared with you about eight minutes ago here is an ADL IADL, MRADL, category on your left combine it with any of the distractors on your right. Again, just trying to give you exactly what I told you you would get from this course and that is

applications in dual task rehabilitation. Not just theories, not just esoteric thoughts about why this might work, actual practical examples. Come back, study that slide again. And I want you to keep in mind that when people dual task they are actively prioritizing. When they actively prioritize, they have to consider of all the environmental distractions that are abound and this task that I must pay attention to, what's the most important thing for me right now? Hit the brakes because there's a pedestrian crossing, or should I shift into a different gear or should I just be driving ahead, or should I be looking at the billboard on the side of the road. Sometimes when a patient is walking let's take it into real case example.

You've got a grandmother who's walking alongside of her six year old granddaughter. She has a choice in prioritization. The granddaughter's telling her about her story that occurred to her in school that very day. "Grandma, I want you to listen to what happened to me." And the grandma has to decide, I can't do both of these things at once. Do I stop walking and listen to my granddaughter's story? Do I say to my granddaughter, hold on just a minute honey, let me walk and get over to this chair so that I can listen to you better.

Or does the grandma attempt to try to divide her attention and prioritize both things at once and either she's successful in listening to part of the story or she's successful in part of her motor control of how to walk? Is she successful only partially? Does she offend her granddaughter because she can't remember the story? Or does she fall flat on her face in an attempt to try to juggle both tasks? Prioritization is one point of the decision tree of dual tasking. You can ignore it, you can stop the primary task, you can stop the cognitive distraction and avoid it or ask for it to be introduced later, and continue on, you have choices of bound. But those choices are only available to you if you have enough awareness to be able to make the decision. So I have to ask you with the red font down at the bottom of your slide, doesn't this sound familiar? How about when you first learned how to drive, didn't you wanna stop getting so much feedback

from the person in the passenger seat? Didn't you find that as distracting from your caregiver that was trying to teach you how to drive? Didn't you wanna reduce your life complexity and keep the radio turned off? Only drive when the weather was good or there weren't that many cars out in the road. These are in fact real world prioritization strategies. Now I wanna share with you a video here using the four square step test and an application in telehealth. Yes, that's me in the upper right hand corner there on telehealth, while I'm working with my patient who has a two-dimensional version of the four square step test masking tape out on his floor. I recognize that this is not the same as the four square step test because it's not three-dimensional, but let's watch in, let's watch the video and let's see what happens here. We're gonna start off in box number one. So he's currently in box four.

Step two is left, you'll see that box one. And show me where box two, three and four is so we've got that understanding is the same, so if he goes in order, here's box one now he steps the box down. Okay, start over in box one now. And here's box four. Okay. Here comes your first string of numbers. Four, two, one, three, two. And I just said four, two, one, three, two. He stepped over to box four, box two, box one box three, back to box two. He did it perfectly And now we'll go back to your hand handout. Two, one, two, four. So that's a combination of an agility test with a digit span overlay.

It's engaging for him it's helpful for his condition in changing directions with Parkinson's disease and it's giving us an opportunity to get some dosage for him that's safe while I am remote. So we wanna consider our interventions across all four modalities of concurrent tasks. Remember, all four modalities being cognitive, manual, auditory and visual. And we wanna consider exactly what I iterated to you earlier. So I am reiterating when to time the introduction of dual tasking. You do so when the primary task meets these criteria and I've listed six of them for you. The primary task can be safely performed as a single task. If you can't walk with this patient and keep

them safe through your own physical assistance or through body weight support, you should not be introducing dual tasking. If this patient's primary single task is not improving or has no potential to improve, you should not be dual tasking. If this dual task is being overlaid on another activity that's too novel, too new and has never been automatized or would never be automatized for the patient there's no need in dual tasking. You wanna do a task that's familiar, interesting, and has some preformed procedural memories for the patient at hand. And finally, what I've iterated to you in multiple times in this course, the task should be important and interesting to this person. So the progression. And I want you to primarily read this for yourself, these five bullet points. Step one, more complex.

Number two, a little bit of novelty. Number three, make it functional task specific for this person. Interview the person to learn enough about them, to know what kind of dual tasking you can infuse. Check their psychological response. Do they need more errors or less errors? Do they need to be more successful? Have you warned them ahead of time to expect a regression? And then finally, you progress into multitask performance. So when we consider this, we have to look at the tenets of intervention. And you know that you're not going to purely just get a manual distraction. You're not gonna purely just get a visual distraction.

Cognition enters in almost all of them. So you're gonna get some overlapping of the modalities. But once you have loaded individual with dual tasking and you've gone through the progression, I want you to consider taking the dual task distraction away and give them the opportunity to perform back again a single task. And you know this is just like taking a weighted vest off and then trying to run faster. It's like taking an ankle weight off. It's like taking a constraint off because it is and allowing the patient to move again. So, after you've done dual tasking I'm encouraging you strongly, to go straight back to single tasking. And now it's time to look at some more videos. We're going to do some case studies because if a picture's worth a thousand words, a video

is worth a million. So, let's take a look at the timed up and phone. No, this is not a test, but let's watch the video and learn a little bit here. Okay, Steve, when I say go, I want you to do the walk test and dial your home phone number, including area code. Don't begin dialing until I say go. On your mark, the timed up and go course. Get set, go. And now he gets up, he goes, and he's got to use a cordless phone to try to dial his home phone. Great. And can you look on the keypad and read me out the numbers?

- 503, 503.

- Is that correct?

- Yes.

- And he got it. Perfect. So we could actually look at his single task performance timed up and go, and we could compare that to his dual task performance timed up in phone and we could actually have something that we could document to demonstrate how much he's interfered with when he's attempting to spread and divide his attention. Let's take a look at the next video. And I want you to guess this patient's diagnosis plays. I'm gonna let you listen in as we watch her walk. A little challenging. Is that surprising to you?

- Yah, I didn't think I'd actually happen.

- Okay. Try again.

- The cross-sectional,

- Makes you think somebody's changing the speed of the treadmill, doesn't it?

- Absolutely.

- I knew, right, but nobody's next to you. Are they?

- No.

- You've changed your walking speed when you're also trying to think about reading. So just try the title. Okay, hands away from the armrests just try reading the title. Okay. Very good. Okay, now that was very very introspective for us to be able to see what happened to her. She was consistently and sequentially slowing her walking speed whenever the reading became complicated enough that she had difficulty pronouncing the words. What's her diagnosis?

Anyone wanna chime in? Raise a hand, stop into the chat bar there, a guess that will not even be penalized. So Renee, what's your answer there. Jamie, anyone, let's hear you throw something up and see, put it into the Q and A if you will. Okay, MS, great guess. Very nice. Thank you so much. Great guess. Renee, great guess again.

Also, Parkinson's disease. Two of the conditions that we've talked about, Jamie, you're right as well. That's another great guess. Parkinson's disease or even a Parkinsonism. We've talked those conditions being more likely to, and being subject to differential losses in performance with dual tasking. Now, I'm gonna surprise you all a little bit. Her diagnosis is right total hip replacement. She was recovering from a right total hip replacement and had made the steps necessary to get to no ambuate or no assistive device ambulation. However, she had lost her automaticity and gait despite her exceptional intelligence at this well-preserved age she could not continue proceduralizing her walking while she was engaged in a distraction. But I need to do that for her so that she doesn't sustain another fall, which was the reason for her hip replacement in the first place. Complex fracture, femoral head, total hip replacement.

Let's go back to your handout. And we're gonna watch another video here next. So now we're gonna look at movement in the background again. And let's take a look at this video here. And Jessica, I'll take your question now. Jessica, I was just wondering if it's encouraged to perform dual tasking for geriatric population, even without any neuro insult. You know my answer now. And actually, there are over 100 research articles written per year over the last seven years consecutive that are just about the effects of dual tasking in aging. Jessica, you're absolutely right. This is necessary. All right, now watch this. Here's a gentleman who sustained a stroke, left sided involvement. He's sorting the cards from the deck as the cards come up randomly and he has to change directions and keep his balance while he's placing the cards where they go.

Clubs go over there to the right. Hearts go, no. Diamonds go here into the tray. Spades go over here to his left and if he picks up a heart he's gonna have to turn all the way around backwards and put it on the table behind him. And why is this relevant? Yes, the treadmill is in motion right now. Here's a guy who's getting ready to return back to work. His office is in shambles. He works at a credit union. He's an executive at the credit union and he's gonna have to go sort piles of paperwork.

But I don't want him to be found down in his room, in his office, I want him to be able to hold something in that left hand reliably, which has a great degree of sensorium impairment and paresis. And I want him to be able to keep his foot work. And if I don't challenge him to do this, who is? Now, watch the next one, I believe is a heart. And there he goes, and he's gonna place it on the backside and he's gonna walk backwards and he's gonna get right back after it again. Carol, I appreciate your comment. Carol says, I'm not sure if I could do that. Carol, I work in Salem, Oregon, and I'm open five days per week. I'll see you next week. All right. So that was so exhilarating for him and really helpful and insightful for both he and his wife to see that. Let's move to our next video. Okay. Touch them all. Hey, if that looks like we are

recreating festination, freezing of gait, that's exactly right. I am causing him to have error-enhanced dual task training. Meaning, I'm telling him to step small and step frequent and to step on each line that he saw that I drew in chalk on the treadmill. I'm gonna play that one over again. Watch all these little marks. Touch, touch, touch touch, touch. And we're causing him to have freezing of gait. It's a dual task interference. But let's watch the next video and see if he can come out of it. He's got five pound weights on his ankles. Now, it's even harder. And we're going to pull that agility ladder in front of him and finally give it to him.

And he's got to step small, and now he's gotta go all the way through the agility ladder and then break out of the festination and step large. Error-enhanced dual task training. Hey, if your problem is that you step too small I'm gonna force you to step too small and then enable you to break out of it. Has anyone ever heard the term habituation? You bet you have. If I don't expose him to reproducing the symptom of festination I'm not going to be able to enable him to learn how to break out of it. All right, let's go to the next video. We're gonna move into an arm application here. One minute down, one to go. He's got to take his more impaired arm and grab a domino out at the same time he does with his less impaired arm using the forceps or tongs. And he's being timed with some fresher as well. That's a pretty impaired right upper extremity you're looking at their folks. But he is thriving and being challenged and he's doing well. This is a push. And if you want to reautomatize your ability to be able to do something with that impaired arm again, you got to do some dual task overlay on top of it.

- Pressure and dual tasking manual.

- That's fabulous. Now, we just made it through Chapter 5. We're gonna go back to your handout and we're gonna start up Chapter 6. That's a tremendous amount of information we just went through. I wanna make certain that we're not moving so fast that we're missing anything for anyone. Be ready to cue your questions for me. I'm

gonna leave time at the end for your questions. Right now, we're pushing into Chapter 6, Measurement and Documentation. So what we've learned is that it's essential that we measure dual tasking's effect so that we can educate, so that we can allow our patients to see themselves improve, so that they can go through the dopamine reward cycle and be pleased with their changes. And we've also learned that dual tasking is obligatory throughout all aspects of life and it's relevant. And it influences safety in mobility and ADLs and IADLs and accuracy and all of the above as well. So when we measure in dual task we're measuring to determine patient intolerance, the dosage that we need, the improvements that we wanna relate to them and what type or modality of distractions we want our patients to experience.

And I've alluded to the equation of dual task cost through dual task testing earlier in our efforts and this is now the equation of dual task costs. You will again be politely reminded that this equation is written in green. Does anyone remember why I'm writing some things in green? Raise your hand out there. Let me see somebody raise your hand that you remember why. There we go, Ryan. Oh my gosh. Look at all of you. You're paying attention for sure.

You're gonna do well on the test. Dual task cost means, dual score minus single score divided by single score multiplied by 100. And you know what? If that sounds a little bit complicated, let's break it down. Dual task costs, DTC. Here are the abbreviations. Dual task minus single task divided by single task. And if that can be measured in attribute, it can be measured in the amount of time, it can be measured in the amount of steps that you take to get from one end of the hallway to the other. Imagine that in home health. Hey, it takes me 35 steps to get down to the end of single task but when I'm distracted it takes me 41 because of festination or because of fear-based cognitive distraction. It can be calibrated in number of losses of balance and so many other ways. So, time to walk, time to dress, time to prepare a meal, time to get out of bed, all of those features as well. Now I'm gonna give it to you one more way so they can be

even more practical. Dual task cost, broken down point by point. Remember DTC equals dual task minus single task divided by single task. So what if single task is your time to dress a button down shirt and that's 78 seconds. But what if, while you are doing that you have to think about five different items that you're supposed to pick up at the grocery store. And you attempt to dress the same shirt while you're also trying to memorize that grocery list. And then when you're dual tasking, it takes you 115 seconds. Remember you don't want that as a minute 15, you want seconds and seconds. So 78 seconds subtracted away from 115 seconds leaves you with 37 seconds. 37 seconds divided by single task, remember at the bottom is single task. When you divide by single task and multiply by 100 you'll recognize the true relevance of how much more time the dressing takes is a 49% cost.

So we look at that and we can document that, and we can measure, and we can relay that to our patients. So when we are trying to determine if our patient needs to be delivered with some dual task treatment we must screen them. And we must screen them and understand that the testing attempts to be very pure and reproducible and does not have to be task specific. Let me say that again. Testing does not have to be task specific.

Treatment to engage a patient should be task specific. And when we work with patients on testing we should not be prioritizing what they are supposed to be paying attention to. Here's a great example, friend mine, Anne Shumway Cook, develop the timed up and go test and the cognitive version of this, the cognitive timed up and go test or C-TUG. Now you can read the rest of that slide for yourself but let's take a look at the particulars. The particulars include, doing the timed up and go physical first. Sitting down and having the patient demonstrate the secondary task next. Show me that you can subtract by three from a random number that I give you between 66 and 100. And then third, let's combine them. On your mark, get set, 81, 78, 75, 72 69, 66 63 and we capture the amount of time and we determine how many countdowns the

patient had successfully. The cut-off, 15 seconds. The limitation, people have varied capacities to combine mathematic skills with movement. Some people will be immediately fearful of doing math subtraction by threes in front of others. Some people won't have the intellectual capacities to have completed that task at all. We need to also allow for some flexibility as long as we can test and retest in the same manner with the patient then we can ask them for some different options. If you don't wanna do math, maybe we could actually spell a six or seven letter word backwards rather than a calculation.

There are options available as long as you can reproduce the same test within the patient and demonstrate their respective improvement. I wanna bring to you the concept of the manual, timed up and go though as well right now. That was additionally developed by Shumway Cook not as a primary, but also as a secondary author. I want you to understand the manual timed up and go cited here, Karen McCullouch, working in the Journal of Neurologic Physical Therapy in 2007, we understand this is how the test is carried out.

But now, we also understand that carrying a glass of water is actually as I cited to you about the fourth slide in this course, is actually just a complex version of the single task of walking, it's not a dual task. Now I wanna introduce to you another concept. Some of you may be familiar with the trail making test. This is trails B or the trail making test part B. It can be known as either one. I want you to consider that this is a test of alternating attention, number, letter, number letter, number letter. I've got to find the number one, now I have to find the letter A. Now I have to find the number two and I have to remember where I was in the alphabet. Oh yeah, letter B. Now I have to find the number three and where am I in the alphabet? Oh yeah, the letter C. And I wanna share with you what we're doing in my clinic. I actually developed this about six years ago is that we're actually combining the agility of stepping on the letters or numbers with the features of the trail making test. So let's watch this video now. He's gonna go

over to three and we hope he's going to go to C, but he didn't. He went to D. Maybe he's gonna go to four, sure. Now, normally he would be a D right now and he's gonna just skip past C all together and go to E. He should go to five right now as all of you know, and he does. Now he should go to, and I'll let you answer this for yourselves. He's having a hard, he found F. And now he should go to the number, it's right next to him. If he can find it, the number six, he's got it. Good. And we'll go back to your handouts and we'll consider an overlay for yet another exam. How about the cognitive version of the four square step test?

There are four different distractions that we do inside the cognitive four square step test. I'm gonna answer Karima. You had asked, what is his age? 71. Any cognitive impairments? Has Parkinson's disease, has difficulty by function of that subtype or phenotype of Parkinson's disease, has difficulty with dual tasking. He's independent, does drive, does make his own financial decisions, et cetera. So, dual tasking is his primary executive impairment. The cognitive four square step test. Many of you are very familiar with the four square step test. And as I page over to the next video it'll look familiar to you here. It's similar to what we saw in the telehealth example. We're gonna watch this patient in just a moment conduct the four square step test as a single task and then we're gonna watch and listen as he does it in a dual task. You're gonna run the four square step test then you're gonna sit down in the chair and do the cognitive naming tasks that we talked about that's going to actually be your water polo teams 'cause that's a favorite topic of yours. Then you'll come back and combine the two here naming a different water polo team every time you step into a quadrant of the score, four square step test. On your mark, get set, begin. Good. 6.77 seconds. Hey, that's pretty fast. 6.77 seconds. See how many different water polo teams you can name. Now, water polo is his thing.

- Cal bearers.

- Great, okay. Now come up and combine the two not using any of the same water polo teams as you go.

- Okay.

- And whenever you're ready. Now, he just named six and there's 12 in the pack. 12, he is clearly familiar with those teams. Let's see how he does combining them though. Ready?

- No.

- And you're good right there. Okay. So, that took you 49. Yeah. 49 seconds to do that. All right, that's gonna be part of how we structure your next home exercises.

- Okay.

- Good job. Wow! That's challenging. He's such a gamer too. And from a personality standpoint, we understand that he was willing to thrive, willing to be pushed, and this was within dosage for him. That's one example of how we conduct the cognitive four square step test. One way to do it is, grab a topic of conversation, patient's choice of what the topic is, name six words while you conduct eight different quadrants. Another way is, serious attraction by three. Another way is, I'm gonna give you six words to remember, you get a minute to memorize them, give them back to me while you're doing the eight different quadrants. And yet another way is, spell a six, seven or eight-letter word in reverse. Let's go back to your handout now. Now, I'm gonna introduce you to the stroop effect and I'm gonna introduce you to the stroop color word test. This is yet another way that we can in clinic and many of your research colleagues are using to test and train dual task tolerance. Imagine the frontal lobe capacities that it takes to be able to inhibit reading the words that you see on the

screen in front of you and instead, naming the color. So if I were to go down the left hand column on your slide and correctly perform the stroop color word test I would say green, yellow, red, black, green, blue. And if I went through the middle column I would say, red, blue, blue, red, blue, red. And if I were to do the end column, I'm gonna pause and ask you to try to read that for yourselves now. Read the color, not the words that they spell out. And if you said blue, black, green, yellow, black, green, you were correct. Imagine, inhibiting the natural tendency of one thing while you insert a new rule for another, that is the stroop effect. We can use the stroop effect to our advantage in rehabilitation so that we can draw a patient's attention away even to a greater magnitude.

That's yet another way to be able to conduct these applications. So I want you to remember that no matter what type of activity task movement sequence you're trying to conduct, you can always run that performance without a distractor, run the performance again with a distractor, compare the two and create a dual task cost so that you can superimpose a work-based, sport-based, mobility-based, ADL-based documentable measure of attention for this individual. That's your functional attention cost it's your dual task cost. We're ready to move into the summary, your questions and hopefully my answers.

I've got a couple more slides to summarize for you and a couple more surprises but I want you to be ready with your questions. So what we've covered so far today, these are summary slides. These are some considerations in stroke. The should be familiar to you because people in stroke have sensory changes and motor control changes, they lose automaticity. They need to regain it through procedural memories not through more cues toward their body. In addition, Parkinson's disease. This is a repeat slide. People with Parkinson's disease have an altogether different loss in performance toward dual tasking because of the physiologic dependence on dopamine for the DLPFC. Lewy bodies and dopamine losses couple in together so that you lose basal

ganglia, lose DLPFC, lose both of your directions and repositories of where you would put a task, multiple sclerosis. Attention for everyone not just persons with MS is a distributed capacity. MS is a distributed disease. Just like concussion, a distributed physiology change. On top of things in persons with MS, for many of them but not all, fear of falling borrows and robs some of their attention. What can we do? Can we load them up with some dual tasking exposure so that we can inhibit some of the fear of falling, so that we can build a reserve of function? Absolutely. And what about concussion? Sensitivities and all of the sensory modalities are more challenging to process after the concussion. Attention is a distributed capacity. That should sound familiar.

Cognitive skills must be challenged but dual tasking is essential for all of those common things that a younger athlete, a younger worker needs to be able to return to and that's why in a concussion, we very consistently see that dual task is a primary reason for people not to return back to full capacities as quickly, or sometimes at all. Nancy, I'm gonna take your question right now. Can dual tasking be used for a basal ganglia stroke?

And I appreciate your question. A basal ganglia stroke typically, even if it's an intercranial hemorrhage, ICH is going to be robbing potentially part of the collective neural structures known as the basal ganglia on one side of the brain likely not both. But remember, the supplementary motor area the premotor cortex and the cerebellum, even in a basal ganglia stroke are still available and viable. So the answer is yes, Nancy you continue to do dual tasking. Partially to push demand and supply and to recover where you had that stroke. Partially because procedural memories are still stored elsewhere. Keeping in mind one thing Nancy, a basal ganglia stroke is Parkinsonism. So let's keep that in mind as well. Great question. All right. Now, as we move forward, we have to consider other summary slides of what did we learn. We learned that every person has a personality and different relative frequencies of success and failure must

be respected. Everybody has different tolerances to different modalities of dual tasking, cognitive, manual, visual and auditory. I have no problem listening to my favorite music and actually studying and learning something new or even talking to you and creating a presentation. Now, I might actually have some difficulty with a visual distraction if I were watching a baseball game while I'm attempting to do this presentation for you. Everyone has their own strengths and weaknesses in DT. But we do know the DT cannot be ignored because it's real world, it's obligatory. It has four different modes of distraction and people regardless of their capacities need to feel successful and challenging.

And finally, we learned that dual task was important because no one should be allowed to be dependent on attention. And we know many different movements and tasks that require that you perform the movement in the background. Remember that phrase, movement in the background. And that's why we challenge people by grabbing their attention and constraining their attention elsewhere so that we can reinforce the procedural nature of their movement. The final slide I'm gonna share with you before my contact information is this Venn diagram. If we have to consider distractibility under one entire Venn diagram, we know that the different relative considerations include, how complex and busy is this environment. How novel is this task? How much experience and exposure does a learner have for this task?

And then finally, the third circle within the Venn diagram is past performance. Should I be anxious about this? Because I did not shoot that free throw well, when I was under pressure at the end of the game last time, or do I have confidence because I've over-trained myself to deal with all those distracting fans and the opposing bleachers that are waving signs or figures of me or yelling chance that don't make sense, past performance, environmental complexity, and task novelty must all be considered when we go in to dosing and treating for dual task. Finally, I wanna share with you my contact information here. And I want you to reach out to me. You can see my website,

you can see how to contact me in social media. And I also want to share with you, which I believe that I can do, let's see here. I am going to attempt to type in my email address because I see that it is left off of here. And that's no problem. It's just gonna give you another moment to start to populate your questions. And there we go, Mike @northwestrehab.com I think I can send that off to everyone here, and Juliet, can you help me with that? I think I've put that up here. Oh, you put that into the notes right there. Okay. Thank you. I see what you're doing and everyone should have my email address right there. And we have that I believe, also at the very, one of the very first slides in the presentation as well. I wanna give you some bonus information and give us a chance to extend a little bit of the learning. Some of the overarching themes that we see in dual task training, cause us to understand that patients that improve learn how to filter, they learn how to self monitor, they learn how to tolerate more and they learn how to avoid environments that are way too much for them. And along the way, they improve the motor skill with the dual task training.

These are the overarching themes. That's not a surprise to you. I wanna share with you some of the future research trends. You can see one through seven that are happening right there because dual tasking is widely written about and studied. And I want you to see these future research trends as well. In addition, I want you to take a look at this study that's happening right here where patients are being challenged to keep their walking speed while they're listening to an auditory distraction and having to relay the same numbers and order of where they see them on that Sodoku-like box when they get to the end of the laboratory walk. And we see that we can measure both things. Speed of walking and auditory memory in a digit span capacity. Take a look at that as well. And the citation is for you, is there for you additionally. All right. I see that there's some questions coming up now and I'm gonna begin to attend to those, then we might have a couple of other things to take a look at. All right. So, Kristen. Are there any manual dual tasks that can safely be incorporated into gait with a walker? Wow! That's a great question. So, you could potentially. If I gave a person with a walker, depending

on how much they need upper extremity support I could give you three or maybe four coins in your right hand and I could say, keep walking with the walker and I want you to hand me a dime or I want you to hand me 12 cents. That's one thing you could do as a manual dual task. If they need both upper extremities heavily, what else could you do? Could they signal to you the number that is the product to the equation? Four plus three equals, and they hold onto the walker with the thumb on one side holding up five fingers and then individual single digit on the other side sharing with you that the answer is six. In addition, if they had to be able to use both hands and wanted to engage in a manual dual task, I'm trying to think of other things you could potentially have a patient snap their fingers in response to something depending again on how much upper extremity support that they need.

You could have them shrug their shoulders potentially or use other portions of their upper extremities, not just their arms. I could go on and extrapolate on a few other things but that's kind of where I would go to start with. Jessica, at what level of proficiency does the primary task need to be at to then add in dual task? Okay. So we did cover a couple of things on this point. What we say is that the patient needs to be at the associative level of learning. They don't need to be at the autonomous level where they can perform things without thinking about them, but they need to be at the associate of level so that when they perform a task, they can actually see themselves make an error and give themselves some feedback on that error.

If I were to just give you one answer, I mean, I could go on for a 15 minute answer, but Jessica, if I gave you one answer I would want the patient to be able to say, oh, that's right. I think some of the times I didn't swing my leg in the right direction, I didn't set the right aspect of my shoe down or I hiked my shoulder blade up a little bit too high. I want them to be able to give some correct feedback about their motor characteristics. And it's okay, I don't wanna be contrary. It's okay for a patient to give themselves internally-based or body part-based feedback. We don't want to give those types of

feedback from the therapist to the patient. All right, I've got another bonus video I wanna share with you, but I wanna tell you, the last four slides are just for your edification to look at some cut-off scores and normalized scores. These came to me from a colleague of mine, Marianna Wingood, and I wanna give her credit for that. And I want you to see that single task, verbal fluency, subtraction by three and manual task, there's some good population-based data there to look at sensitivity and specificity and the cut-off scores are listed in seconds. Single task timed up and go, 11.3 seconds. For the same population, 14.7 in verbal fluency subtraction by three, 16.8 and manual task, 14.9. The next few slides in your bonus slide handout also look at the same type of capacities. Maximum gait speed, backward, and the timed up and go all by itself. Juliet, let's cue that last video if we could please. This one we shot today in the clinic.

And due to the proficiency of the Continued team here we get to see tasks that were shot today. This is a patient recovering from stroke left-hand impairment and he is using an upper body ergometer. Now, watch as he performs this, when he flips a card, if it's red, he needs to reverse the direction of the UBE of the upper body ergometer. Up, you got to reverse your direction. If it's black, he's supposed to continue same direction. And he has enough sensory compromise in this left hand that normally he would actually lose the contact with his left hand on the pedal for the ergometer but he's doing a great job dividing attention now.

Red card, reverse. Black card, continue. Let's watch him do a couple more cards here. Red card reverse. Come on. He did it. That's great. So we'll let this video play for a couple more moments and I want to watch for any questions that come up and if no other questions come up, I want to certainly, again just echo my sentiment of appreciation for your attendance and engagement today. You've asked some wonderful questions. I imagine I'm gonna hear from some of you by email as well. Juliet, do you think we could pause this slide and maybe fly all the way back up to the

top of the presentation? I believe my slide with my picture on the front or at the beginning, something in the neighborhood of about slide number two actually had my email address, is that right? It does. Yeah. So, my slide, there it is right there. Thank you. So use my email address, contact me for more learning experiences through Continued. Thank you so much for your time tonight. I appreciate the comments that are coming in right here as well. Thank you Rebecca. Thank you Karima. I appreciate it. Be watching and I've got several other presentations on the Continued library and I hope that you all will consume those. And thank you, Deborah and Ryan. I appreciate it very much. Yep. I will sign off for tonight I'll turn it back over to Calista, if you have any final comments to instruct our learning attendees tonight.

- Wonderful. Thank you so much, Mike, for presenting for us once again today. And before I close out today's course I do wanna remind everybody, next week we have a bunch of courses coming up and that was organized by Mike and they're all courses on the Jerry Athletes and Mike is presenting as well next week. So please take a look at the site and all those courses that are are coming up one a day for every day of the week next week, and I hope to see you in the classroom. Thanks again Mike, such a wonderful course and thought out videos. We really appreciate it, wonderful content.

- Thank you so much. And I appreciate your comment about next week. We're really looking forward to the Jerry Athletes full week long presentation. So I'll hope to see some of you there as well.

- All right. Have a great evening everyone and thank you for joining us.