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## Impact of Motor Learning: Daily Life and Play Recorded Aug 24, 2020

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- [Fawn] Welcome back to part two. This is going to be on the "Impact of Motor Learning: Daily Life and Play." Again, our presenters are Lisa Roehl and Mariah Woody, and Mariah is going to start us off.

- Hi everyone, welcome back. We are going to quickly just jump through the presenter disclosures and the video and photography disclosures, they're all the same as the previous section. We're gonna head straight to the learning outcomes. And what we have for this section is we're gonna identify a little bit deeper into the theories of motor coordination. So we're gonna talk about praxis. We're going to talk about the five signs of motor coordination pyramid within activities of ADLs. We're going to talk about the five signs of motor coordination impairments within gross motor milestones. And we're also going to talk more about at least two ways that social skill plays into the motor coordination development of the child with ASD. We touched a little bit on this on the previous hour and now we're gonna delve a little bit further into this. Okay, so we're gonna talk about rhythmicity, and rhythmicity is kind of interesting because we don't always think about it, but everything in our body has rhythm. Remember how we talked about the cerebellum and the cortex and how it needs to sync up? So that breakdown also happens frequently. Let's talk about breathing. Let's talk about your heart rate.

Let's talk about eye movements. Let's talk about hand coordination movements. Let's talk about even back in infancy that natural rocking motion that kids start to develop before they go into crawling. All of that is rhythmicity. And so when children lack rhythmicity, they usually lack self-organization skills, balance and body awareness. I know for me personally, rhythmicity is not my thing. It does not mean that I have autism but I'm the one that frequently has trouble staying on a beat. I'm one that frequently holds my breath. Apparently when I was an infant, I had trouble with the suck, swallow, breathe with breastfeeding. And so a lot of our children, when we have issues, even in that early stages, it doesn't necessarily mean that they have autism, but it does mean, hmm, this rhythmicity should be natural for children. And we want to go back and stimulate that cerebellum and try to engage it. So rhythmic auditory cuing

can be appropriate technique for predictable structure to stabilize variability and movement. This is where the Interactive Metronome comes in. I'm sure a lot of us have heard of the Interactive Metronome. They put out a lot of research, but it's that auditory cuing. And even in the Interactive Metronome, we'll talk about this later, but even if the child isn't clapping on the beat, just that metronome can be very organizing. And this is why you want something that is rhythmic as a prep, or even during a motor coordination activity because it can be very organizing for the brain and the body. All right, so we're gonna jump straight into praxis. Praxis is a big, big, big topic. And this is going to be a crash course into praxis, just enough to tune your therapeutic lens to it with your children. And then you can take even more courses on praxis. Teresa May-Benson is the leader in praxis development. We're gonna talk a lot about her, but for this purposes we're gonna just use some overarching details. Forgive me if you get a little lost in it, there's a lot of definitions that you'll have to know but we're gonna try to keep it as simple as possible.

So praxis, what is it? First of all, the definition of praxis is highly debated. For right now we're gonna use the sensory integration frame of reference. What this means is we're gonna take praxis to more of a sensory foundation. It's the ability to adaptively respond to your environmental demands. Can you adapt to novel and challenging environmental demands in a way that is meaningful and efficient? We're gonna break this down even more. Essentially praxis is required in everything. From the moment that you wake up to the moment that you go to bed, you probably use praxis, I don't know, 50 times before you even walk out the door in the morning. And so if you're having a morning where you need your coffee to be able to wake up and you don't have very good praxis until you get your coffee, imagine what it's like for children who are constantly in this stuck pattern all throughout their day. So what does praxis require? This is also where we get into the bridge between OT and PT is that OTs aren't the only ones that deal with sensory processing. PTs as well have to deal with it to understand their children and making sure that we together are treating a child on the appropriate foundation. So praxis, they have to process sensory input, in particular

with the sensory processing frame of reference we're looking at tactile, proprioceptive, and vestibular, gustatory, auditory. All that stuff is kind of left out to the side, but it also requires a spatial temporal recognition. So time and space. This is where rhythmicity comes in. This is where fluidity comes in. Lisa talked about in the previous segment about motor memory. Praxis requires motor memory to be able to further develop this. Motor memory, let's take the little girl about to throw the cube at the Velcro board. Well, she knew, she remembered, "Oh, these balls stuck. They have Velcro to them. Hmm, wonder, what's gonna happen with this cube?" And then she eventually could coordinate and figure it out. She utilized her praxis skills to get the cube to stick. We're gonna talk about two different mechanisms, feed-forward and feedback. These two things can be, they can be a little confusing but essentially what feed-forward is, is it requires the body to be able to pull from previous motor memories and plan while it's being executed. So can you see how if the cerebrum and the cerebellum are having difficulties firing together how this might be challenging? So it means that the task feels new every single time and it's hard to adjust.

So a good example of feed-forward would be if we're kicking a ball back and forth, I don't stop the ball before I kick it. I'm just gonna kick the ball as it's coming at me, I have to adjust, if the ball is going to my side, I better be running over there. But what happens to a lot of our kids with some delays in this wiring, with some delays in this timing? The spatial temporal recognition, that vestibular input of something's moving, and I need to move over there. This can be pretty challenging, okay? So where feedback comes in is they understand what the body did, how the action was performed, and what was done to the environment. So feedback means, I just kicked that ball. I stood on one leg, my other leg kicked the ball, the ball moved. Oh, and it got over there to that other person, that's feedback. But feed-forward means I need to quickly adjust my body to use it and to get the job that I need done. I hope that's making sense, because we're gonna talk a lot more about feedback and feed-forward. But also from a neurological perspective that poor long range connectivity between the cerebrum and the cerebellum and the visual and the motor areas, have been thought to

underlie the imitation in praxis impairments in autism spectrum disorder. That's gonna be really important is think about how long range these connectivities have to happen. So when we think of, "Yeah, I'm giving them this visual feedback now." Give them time, give them time to process because those neurocircuits have a long way to go. So we're gonna watch a video. This is my son actually. And I just want you to watch it first and then we're gonna talk about it. So he's getting on his little roller coaster, roller coaster goes, he's having a great time. He gets off. He's struggling a little bit there, 'cause the car keeps on rocking. But we figured it out. And now we're gonna do it again. Huh, we got the same result that time, okay? So we're gonna watch through this again and I'm gonna talk you through it. We're gonna talk about feedback and feed-forward mechanisms.

Okay, so car's rocking, that's okay. We have good postural stability. Oh, the car started going, I better sit down quick. Okay, feed-forward. We adjusted, car moved. I could change quickly. Fortunately for this video the car slid back onto the track quite easily. That does not always happen, he gets very frustrated. But then he eventually figures it out. Some of our children with autism spectrum disorders stay frustrated. They can't figure it out. And imagine that being your case day after day, several times a day, you would constantly stay in this frustrated state. But he's able to figure it out. He understands that he needs to get up to the car. So he's gonna step up those stairs, scoot over it, and he's gonna push off again. Y'all he did this probably 15 times before he stopped. Children with praxis difficulties do it two or three times, and then they stop. But kids who are more neuro-typical do it over and over and over again. And those neurocircuits build on top of each other. So they're able to pull from their previous motor learning even faster. Okay, so what does praxis require? If they can do a task once, why is it so hard for them to do it again? We always think that. I've caught myself saying to my children, "Oh right, you already did it once that shows you you can do it again." That does not mean that those neurocircuits got connected. Usually they have to do a minimum of five times before all of that starts to sync up. So not only that, but that is doing a task the same way over and over and over again. Imagine this, what

would happen if something changed to their routine or environment? I watched a video in one of the praxis courses, and it was of this woman who was cracking an egg. And she always cracked the egg on the same bowl because she knew with that bowl how much force to grade. Well, what if that same bowl wasn't there? What if it switched from a metal bowl to a ceramic bowl? Or what if that bowl altogether wasn't there? What if she had to crack it on the counter and had to use a pan? So something about her environment and her routines would change. What feedback and feed-forward mechanisms would she utilize? Dyspraxia and autism appears to be associated with impaired formation of spatial representations.

So spatial temporal, here's that definition again. And they have to be able to transcode and execute. It takes it from a motor coordination and a very primitive standpoint, all the way up, back up to that pyramid of learning and utilizing their cognition. This is why that praxis definition gets so fluid is because people will argue that it's cognitive. When really, I think it's much lower than that. And so you have to use all parts of your brain. You have to use the parietal, premotor and motor circuitry as well as various connectivity within various tasks. So praxis is a strong ability of defining social communication and behavioral characteristics, which right now are primary features are the autism spectrum diagnosis. Why is that? Well, in our previous segment we talked about social communication and motor coordination. Okay, you have to be able to think and adjust your body and you have to be able to have some timing and rhythmicity in the way that you speak. There's a cadence involved in the way that you speak. When you speak, what does your heart rate do? What does your breathing do? What is your body doing? Do you understand what your body is doing in social situations? How is imitation a factor in social skills? Can I see this other person? And can I coordinate myself to do what they're doing? If I see a kid playing on the playground, am I going to sit there and watch them? Am I going to be a sensory avoider and an over responder and just watch them and take it all in? Or am I gonna jump in and try to imitate exactly what they're doing? So now we're gonna talk about praxis sub-components. We have ideation, which is the idea of the action, motor

organization and execution. I hope you all are with me so far. I know that this is very fast paced for praxis, but we're gonna talk now more about ideation. Ideation or the idea of the action. This requires something called affordances. Affordances is the qualities or properties that inform a person about the possible actions, okay? I know with my cup that I have right here, I can drink from the straw. I can take off the lid. I can switch the lid. I can swirl my cup around. I could drink from the cup. I can bang the cup. Not only can I do this in my right hand, I can also do this in my left hand, okay? We are going to take a look at this next video. And this is a model of something that Teresa May-Benson has developed. And she has worked on a piece of research, including a very short test, it's called the Test of Ideational Praxis. You can look it up online. This will be in our reference guide of how to get access to this test, and we'll also be talking about it at the end. But we're gonna watch this video, and essentially what happens is this little boy is taking a string and I ask him, "Show me, show me all the things that you can do with the string." We're gonna watch it once, and then we're gonna talk it through. I think it's kind of hard to see the string but you can see his motions.

So one thing that I will point out if you notice with this string he's doing a lot of gross motor movements. Sorry, I have terrible cinematography skills. He lost his string is what he's doing and now he has to go and find it. So again, he has to use his spatial temporal recognition, more spatial than anything else. And this is also where visual comes in. Visual isn't necessarily a part of praxis but he has to know from previous experiences where to look. He knows he's got to look on the ground, but it gets a little hidden. We can go ahead and start the video over. He eventually finds the string. I didn't leave him stranded for good. Okay, so he shows number one, he shows us one affordance. I can spin the string in a circle. Oh, I can hop with the string. Look at that, the string is my buddy. I can do things with it. So that's two. I can spin with the string, that's three. I can drop the string. Hmm, I'm kinda gonna go back to number one where I spin it in a circle but I'm gonna take it a little bit more elaborate. And now I lost the string. So I got four, maybe five affordances. What researchers have found is that

children with autism will give us the same amount of affordances as children with typical processing. But what they find is that they don't expand on those affordances. If you notice he use his right hand only and he only did gross motor skills. He treated the string as if it was his buddy most of the time, or just kind of manipulating the string instead of seeing how the string interacted with his body. He never wrapped the string around his finger. He never wrapped it around his wrist, but then also if we're going to expand on affordances, he only did it with his right hand. He never switched and did it with his left hand. He didn't use other parts of his body to do the same action. And so that's something that researchers have found is that, you know, if they're trying to show how many affordances a child can give and interactions with the toy, they're very limited to one body part or one part of their body, even though they can give lots of different actions within that, that's great. Think back to our babies, okay? The way that they start to explore and understand how their body interacts with the environment. If they can only think of just a few things and not understand, "I can reach with my right hand and I can reach with my left hand. Or look at this, I can turn my head and go both ways. How can I use and expand my body to access my environment," is a big challenge for some of our children.

So we're gonna look at the subcomponents of ideation. All right, this is a big one. The knowledge of objects. I have to understand what this object can do. The knowledge of actions. I have to understand what I can do with the object. I have to, well knowledge of actions and also appropriate action, object interactions are, they're kind of the same, but then also knowledge of serial actions. So what can I do over and over and over again? Your knowledge of objects involves affordances. What are the properties that the object can afford? The string, I can wrap it. I can stomp on it. I can throw it. I can spin it. Great, that's what the object can do. I can put things on this object, okay> This goes back to object exploration when you're a baby. If children have trouble with object and object manipulation, you go back, you go back, you imitate. You want to help them explore what these objects can do. And knowledge of actions is how does my body interact with the environment? You have to have an understanding of what

the body is and what the body feels like. So I understand when I'm picking up my cup, I'm not gonna grip it really, really, really hard, I'm gonna grip it just right, okay? That involves some force gradation. But I understand what my body feels like. I understand where my hand is without looking at it. I can feel it. There's other terms for this, but again, we're just gonna gloss over. The knowledge of appropriate action object interactions. I think this is pretty self-explanatory. How does my body interact with the object? Knowledge of serial actions. You have to sequence the basic steps to accomplish a goal, and that's a pretty good start for a final plan.

So an example. If a child says, "I wanna go see my mom." Okay, mom's outside, waiting in the car. There are a lot of serial actions that have to happen. There's a lot of sequences that have to happen. I have to get up. I have to walk. I have to hold the door handle. I have to push the door open. Now I have to put on my shoes. Now I need to sit down. Now I need to use two hands to put on my socks, I need to use two hands to put on my shoes. I hope my body could hold me up while I do this. And then I'm gonna stand up again. Whew, hope I don't get dizzy. And then I'm gonna push open the door again. Which car is mom in? Ah, there's mom. All of these things are very rote and easy for us because we have pretty good ideation if we are generally neuro-typical. But for some of these kids, that's a very cognitive level activity that we need to bring it down into their hierarchy to where, okay, we're gonna help them sequence to where they can be successful. We're gonna go on to the next subcomponent, which is motor organization. This one is required for learning. This is key to learn how to manipulate objects, use tools, imitate, explore, and adapt. The body scheme is critical to develop learning how their body can impact and adapt to the environment. I like to reference babies a lot, because this is where a lot of this initial brain development happens. So babies are getting a lot of that praxis feedback. We're getting the tactile, we're getting the proprioceptive. And then we're also getting some of that vestibular component as well. Think about when we're prone, and we go to roll, we're getting the tactile feedback of the floor, but then man, I'm also crunching up and using my body for that proprioceptive input. I'm also getting a roll, which is a little bit more vestibular. Motor

organization also involves bilateral integration. This a much higher level of motor organization. I find us therapist tend to forget that. I know I have frequently forgotten it thinking something as simple as socks, because at a very young age children should be able to put on and take off their socks. But it really requires a higher level skillset that if we have impaired reflexes, if we have impaired sensory perception, posture, self-organization, rhythmicity, it can be quite challenging. So again, bilateral integration requires that vestibular and proprioceptive input. How? Think about shoe tying, think about writing. Think about, let's see, what are some common things that my PT friends do? Climbing upstairs up on the playground, lots of bilateral integration. I have to have some of this depth perception, understanding where my body is and coordinating and being able to feel my body. I will interject this. This one is also highly debated in the praxis world. And that is, what is tactile and what is proprioceptive? They consider tactile input. I say they, as in where I got some of this research from. The tactile input is something that I frequently thought of as proprioceptive input, such as crawling through a Lycra tunnel. There is some proprioceptive involved because you are crawling against resistance, but it's also a really great tactile input, because of the feeling of the Lycra cloud.

Some of these researchers thought that giving a hug, as in me giving the child with autism a hug, is more of a tactile input than it is proprioceptive. Because their Golgi tendon organ aren't being stimulated. So think about that. That might be a game changer for some of your children of, "Huh." Are their muscles firing against resistance? Is that actually helping them feel their body or did I actually just stimulate their tactile systems? Whereas praxis again requires the three, vestibular, proprioceptive, and tactile. You need all three. All right, jumping onto more motor coordination, projected action sequences. Going back to the period of learning. This is also a high level motor organization. For us it's usually automatic as a neuro-typical adult. For children with autism who have praxis difficulties, it is not automatic. It utilizes a lot of feed-forward mechanisms, which means I need to quickly adapt, change, change, adjust. And I find that sometimes, I think before I truly understood praxis, I

was treating a lot here, and I was wondering why my children were getting so frustrated because I thought this is where they needed to be. And we work on these projected action sequences and bilateral coordination because they need these things to be able to function in the real world. But do they have the foundational skills? Do they understand their body awareness with the environment? Do they understand their own body? Do they trust their body? It's gonna be really hard for them to climb a playground if they don't trust their own body, because then how can they trust the object that's holding them up if they don't understand what they're feeling? You know, do we help children walk before they can stand unsupported? Obviously no, but it's kind of the same thing with OT and PT. What happens here? We have to again develop the body schema. We're learning object affordances. We have to understand our environment and we have to understand ourselves. Think about ball skills and our sports skills. All we want is our children to be able to play with our peers.

This is where autism and having a dyspraxic type presentation involve social integration is because if it's hard for us to move and participate with our peers, well, I don't want to then, because that's too hard. That's just another level of an area that, how can I participate truly? I don't wanna just participate on my own. I wanna participate with others. And then we have execution. This involves a lot of the precision and refinement, going back to the cup. This is where I get my force gradation. Can I adjust if somebody filled up my cup before without me knowing it? Oh, I can quickly adjust and make sure that I'm holding onto it. Or if my water had sweat, now it's all wet. Can I grip it a little bit harder for me to accurately hold on to this? I'm not going to just jam this cup into my face. I'm gonna go kind of slow. And I'm gonna know how to tip it just right into my mouth. How many kids spill water out of their mouths, taking away oral motor control but how many kids don't quite know quite how to grade their force and be able to refine their activity? Again, this is where the cerebellum comes in. All right, so let's watch this rhythm and timing one. This is probably, I don't know, the sixth or seventh time, and the child still had a hard time standing on the correct side of the rope. And he jumps, oh man, he fell all the way to the ground. That was hard. We

had a hard time coordinating, having a good rhythm and timing with our body. And we used too much force. We didn't know how to jump quite lightly to clear the rope. So we had to go all the way down. Oh, oh, but I quickly adjusted, oh, the rope is coming again. I need to jump over it. But having that whole body control made that task feel unsuccessful. So if you noticed, we quickly terminated the activity of like, "Okay, we need to go back a second." All right, types of dyspraxia. There's several types. We're just gonna focus on the general dyspraxia. There's way too much. I would explore this a little bit more on your own or take a very praxis specific course to learn a little bit more about this.

So we have general dysfunction that affects all parts of life. Most children with autism fall into this category, delayed milestones, challenges with ADLs and play skills. The tactile proprioceptive vestibular sensory systems are not syncing up correctly. Our postural control. Again, are they low tone? Are they high tone? I would find that most children have some kind of tonal difficulties that make this co-contraction difficult. It makes breathing difficult. It makes again that suck, swallow, breathe difficult as an infant, you still have posture as an infant. Even if you're being held, you still can hold yourself up. All right, and then we have ideational, we already touched on this. Kids that have trouble with ideational praxis, they usually do not want to play alone. They need somebody to play with them and to show them how to use toys. Be careful with that, because sometimes it might look like, "Hey, they have really great social skills." But if you really watch them play, the child or the adult is doing a lot of things for them. They like to watch other kids play. Sometimes they use the toys in the same exact way. They will avoid novel toys and environments because they're not quite sure how to take previous knowledge and apply it to something new, even if it's very similar. And they also have trouble with sequencing and activity. All right, we're gonna watch this little boy with some ideational praxis. This, I kind of experimented with him. I took it a little bit more with the string, but this one was familiar. He knows what a paper towel does. He knows that he can rip it. He knows he can throw it. It's a little bit more novel, but then after two, oh good, I can step on it. And then he starts to explore it like a jump

rope, ugh, and it ripped. So it's like one novelty at a time. And then he goes back to some gross motor stuff of I'm gonna fling it around. This is what I can do. He's a really fun kid. Okay, but if you notice, he frequently has to stop. Some of that is him being distracted. But some of that is, "Uh-oh, what am I gonna do next?" And I'm telling him the whole time, "Okay, what else can you do? What else can you do? Can you pick up the pieces now?" And then he crumbles it up into a ball, into something that he recognized before. He knows that he can crumble paper.

So he got the idea and then he utilized it. All right, next up is somatodyspraxia. All right, this is where it's just strictly motor planning. It's not necessarily ideation. It's just the straight up motor planning. This is where they have trouble with understanding, keyword understanding, their tactile and proprioceptive awarenesses. They have trouble planning and executing our motor actions. If we have poor tactile discrimination, we're gonna be clumsy. We're gonna drop things. We will constantly need some visual monitoring of our body movements. We'll see some poor clothing management. These are the kids that come out of the bathroom stall with their underwear hanging up outside of their shirt. And they look at you like, "What?" Everything feels fine. They don't understand what being disheveled feels like. They don't always pass a certain age. Mind you, they don't always understand that the shoes are on the wrong feet. These are the kids that have great difficulties with imitation games. They have trouble with self-care. They're messy eaters. They have trouble with utensil and tool use. They have a lot of fine motor challenges. And again, the same consistency with praxis. They have trouble interacting with novel objects. That little boy that we've watched a couple of times. When it's something new he will frequently say, "This is hard. I don't like this." When they've never even played it, or I've got another child who I'm doing teletherapy with, and I'm always pulling out new online games. And he looks at the game. He realizes, "I've never seen this game before." And he says, "Ms. Mariah, I hate this game." "Really? Have you ever played it?" "Nope, but I hate it." Oh, okay. It's because it's novel. They're already afraid. They hate the feeling of being afraid because they don't know how they're gonna motor plan

or create the idea of something new. Even though it's something that all of these kids end up enjoying because we meet them at the appropriate foundation. And then they wondered why we never played it before. We're gonna watch a video. These are twin girls. They have a lot more than just somatodyspraxia. But if you look at it just through the frame of somatodyspraxia, it's a pretty good frame of reference here. And so they're twins with very similar diagnoses. However they interact with their environment completely different. And we're gonna watch this video a couple of times. It's a little long, but if we're watching two girls here I really want you to understand what we're seeing. And there's Lisa coming in and cuing her. 'Cause she left the water on.

Okay, body awareness. How did my body interact with the environment? Serial actions, sequencing. This is that somatodyspraxia, trouble with tactile and proprioceptive awareness of, I just pulled all those paper towels out. I meant two grab two and I just grabbed 20. All right, so what do we have here? We're doing a daily routine. Body scheme and awareness. Look at their posture. Look at them having to apply the appropriate force and the tactile inputs of getting the soap out. I have to engage a little bit of proprioception in there to be able to push my body and hold my body up. They need lots and lots and lots of cuing for how to get the soap out. We're gonna help them on through. Okay, need a little bit of help with that sequencing to turn the water on. And as you noticed towards the end there they needed a little bit of help of turning the water off. But that whole decreased body scheme and awareness, we're needing a little bit of help to understand, I still have soap on my hands and I need to wash it off. So there's Lisa helping her out with get, making sure the hands are getting thoroughly washed and I'm gonna play in the water 'cause it feels good. So hopefully that's a good little segment there. All right, we're gonna talk about bilateral integration and sequencing. Difficulties with vestibular and proprioceptive inputs. My personal theory with the vestibular input is that it requires a lot of depth perception and spatial temporal recognition. And so therefore it's classified with vestibular. So shoe tying for example. We gotta use both hands just as. I think that's pretty self-explanatory and we have to have good posture. All right, one of my favorite activities to do is this next

video. I think it's video, yes. We're doing a little bit of reflex integration there. She's having to coordinate time and space, rhythmicity and fluidity to be able to use both hands together. And now she needs to be able to grade her force to be able to pull her hands up the rope. Now this little girl, her palmar reflexes are making it difficult for her to be able to let go of the rope and then grab on. This is probably the third or fourth time in this particular session that we did it. And then when she was finally successful.

So I love this activity. We're getting some of that vestibular input but we're also getting that bilateral integration and that sequencing, doing the same movement, integrating also the spatial temporal recognition. We're gonna, due to time we're gonna skip over this next video, but essentially what was happening is I was having her push her hands off of the swing, building on the previous activity of, "Huh, if I push off the floor here the swing goes." All right, praxis and imitation. This is where the social skills become involved. The social motor coordination in the form of both imitation and interpersonal synchrony is critical prerequisite to successful social interactions. Usually for all sitting around at a table, a lot of people are sitting in a pretty similar way. We're all doing the same thing. Truthfully, if we're not doing something that involves imitation in a social capacity, I personally think we're missing something with our treatments. Because we're missing part of the brain that needs to be firing, okay? Children with autism face limitations and basic gross motor skills and interpersonal synchronization.

So here's our little friend again with the string. I wanted to see him do some split body coordination. What's the upper body doing? What's the lower body doing? Not only that, I threw in a little kink saying lower body has to do something completely different. He also has a little reflex. The ATNR are still hanging on there just a little bit. But it's hard to play with kids on the playground if we're having trouble with rhythmicity, imitation, spatial and temporal movements and synchronization. How can we learn how to play tag and kickball and race from one fence to the other and navigate the mulch and roots that are sticking up out of ground if some of these are still impaired? Interpersonal synchronization, it allows people to adjust their behaviors to one another.

The component here is our mirror neurons that are found right back here and behind the frontal lobe. What happens is when we're imitating each other, there's this level of connectivity that happens at a very neurological level and our brains need that feedback to one, feel socially connected. When we feel socially connected, we feel safe. And therefore we want to be able to explore our environment a little bit more. You guys can read these slides. I don't think I need to read them off to you, but keep in mind that imitation and the synchrony is a really big part of relating to kids. Even if you spend the first five sessions of just not teaching them anything but imitating exactly what they're doing to help them feel safe and connected with you. There, what we've noticed is that the brain also hangs onto some preservation and being imitated. Even if our body awareness is lacking, the brain still holds onto, "Oh, I'm being imitated right now." And then it's a good way to start making some eye contact. What we noticed with our children is over time they start exploring objects a little bit more and a little bit more, because we've given them a little bit more feedback.

Some key points, early motor proficiency is an indicator of optimal outcomes later on in childhood. Motor delays increase with age, so keep that in mind. You've really got to stay on top of those foundational skills to help them stay on top of the demands. When compared to the social and communication domains research in the motor domains is relatively underrepresented. I read a lot of research that they're trying to change this and incorporate this more into some autism testing and diagnosis. And next we're gonna talk about the four areas of ADL functioning. There's ADLs, play, behavior, and social emotional skills. We're gonna review the vestibular proprioceptive and tactile involvement. A lot of ADLs require body scheme, body awareness. And we're also going to use the learning hierarchy pyramid. We just talked about that one. So we're gonna jump straight on into ADLs. You know, handwriting can be considered an ADL. When for our OTs, I can't tell you how often I hear of a teacher saying that they can't write when you have them just copy a basic alphabet and it might look okay. But think about what goes into actual handwriting. Or they'll get classified as having trouble with written expression when it could simply be praxis. So they're concentrating on forming

the letters. They're exerting a lot of effort into the mechanics of writing. They're having to work on their posture. They have very little resources left for the conceptual part of the written expression. So again, we have to go back, what's causing trouble with written expression? Meal prep, pouring a liquid. We've already touched on what pouring a liquid all of that contains. You have to grade your force. You have to be able to open the twist off cap. You have to be able to open the fridge. You have to look and try to find which liquid you're going to pour, get the cup, but choose the right size cup. Know when the liquid is high enough in the cup, and then we're done-ish Household chores. Again, we're getting more and more cognitive here. Even though they're simple routines when they're new, it can be pretty tough. And so we have to create a supportive environment for these children to get these motor learning patterns. And then other areas of ADLs is play. A lot of our kids have difficulties generalizing a skill.

So for example, walking like a T-Rex or using a banana as a phone. Generalizing, these skills can be very difficult. Usually they don't enjoy a lot of the physical activity because of how many resources it requires of the brain. And then behavior, we've already touched on behavior. But if at the basic learning pyramid here is reflexes and sensory and then midway up is motor coordination. If we have trouble with the foundational skills of, what is my body doing, and from a neurological level, how are my neurons firing to get my body to coordinate? We have all this, gosh, every single activity would be frustrating. You know, think about how you come home and you were just spent from the day because you've had to utilize all of your resources and you kind of have a short fuse. That's kind of what these kids are dealing with over and over and over again. There's a lot more issues into the behavior than just motor motor coordination. But what we're saying is that motor coordination and its impact on behavior needs to be heavily considered in how to successfully utilize their adaptive behavior responses. Going into more social emotional. Kids are working really, really, really hard all the time. Again, the little boy with the string and with the paper towel he frequently says, "I can't, I need help." And there was a point where he wouldn't even try an activity. And now we're at the point where he's trying a brand new activity and, excuse me, and he just

says, "This is really hard." And I look at him and I say, "We're just practicing, no big deal, we're practicing." And that gives him room for failure. And we're also doing all of these activities together. So whatever he does, I do. And I correct him sometimes to be successful. So when they have increased dyspraxia factors they're gonna have increased anxiety approaching to a task, because they already know that it's gonna be hard. All right, so we're going to jump into some gross motor development. And Lisa's gonna talk about that.

- As we look here what Mariah described as all these things play into our activities and all these things play into our ability to access an environment. One of my key things I always say is access to environment. What does that mean? That is what physical therapy is all about. What is our access and how do we get there? Are we mobile? So this begins very early on. We look at your early motor milestones and I kind of broke these next couple of slides up into age, so you can really kind of see what is important. The main thing to consider for that early motor milestone between zero and two is really that crawling. Why is crawling so important? And why is it so vital when we see these kiddos with ASD, when that factor is missing? If we miss that early motor milestone development, it's because we are delaying or we're skipping over a bilateral coordination. What Mariah talked about is that upper and lower body coming together, rolling and crawling and pull to stands are one of the first factors in which you need to utilize upper and lower body and your core. A lot of times you'll hear that kiddos skip the crawling phase or don't last very long in it. So you'll hear that key factor of, "My kiddo went straight from rolling to walking." And that should invoke a flag for you, that should invoke a response that you need to be able to now consider that some of that development, again when we look at the maturational learning models or the trial and error learning theories and dynamic altogether, if we have not integrated in some of those reflexes very early on we are going to see some of these deficits later, and that was gonna affect our motor learning 'cause it got too hard for us. Again, posture, we've talked about that fairly frequently. You're gonna see some of your W-sitters, what I referred to as the deep squat sit. That's when I sit real deep into a squat, but I'm

not actually sitting in tailor sit. I'm not in W-sit, I'm just squatting really low and I'm hanging out on my ligaments. Why do I do that? I don't have to work. I hang out at the end. You're gonna also hear in this early motor milestones that earlier late onset of walking, why am I not walking, am I walking too early 'cause I'm skipping crawling? Or why am I having a hard time getting to walking? I'm taking way too long in the middle. I'm taking way too long in the middle because I don't wanna release from that physical support. It's too hard for me to understand, now I've got to take in so many other factors or I have mastered how to crawl. This is my way to get around. This is my mobility. This is my point to access my environment. I don't understand the importance of why would I want to walk? It's really hard. I keep falling. I don't like it. I'm getting too much vestibular input. It's too much sensory. Everyone's loud whenever I do it. Those are different things to consider why am I spending too short or too long in a phase?

So we kind of expand to the two plus years. We're gonna also see a lot of times these children with ASD, we see this stopping of gross motor development. We're seeing a peak in functional ability or interest. This is where your kiddo with ASD has already learned how to walk. They can go up and down basic stairs to get in another house and they can just move. They can move just fine if the parent is holding their hand. They can move just fine to get into the daycare, get into the school. But now I'm out on the playground and I'm getting lost with my peers because I don't know how to jump. I don't know how to run. I don't know how to go farther. And a lot of times physical therapists take this boy and we stop, because we say, "You are mobile. You got to your environment. I don't understand what I can do, because you don't respond to me when I tell you how to jump. You don't understand whenever I'm mimicking in front of you." But that's where we wanna take in the motor learning. Are they stopping because the praxis, the motor learning aspect is missing? Or are they stopping because of all these things coming together? So again, that's where we break down the activity. Why are they not jumping? Is it because they don't understand the importance of jumping? Let's show them why it's fun, it's engaging. So again, a child with ASD is a spectrum. So they could be all over the place but that doesn't necessarily mean their gross motor

or their fine motor or sensory development has to stop at a certain point. So the main thing you're gonna always see is kind of this delay or avoidance of whole body bilateral coordination milestones which we talked about, listing some things here. We've talked at length about playgrounds, climbing up and down those. Jumping jacks. We've seen some of those movement patterns, jump rope. Obviously that is a lot of things to coordinate together our timing and our sequencing. Again, think of mobility beyond just walking, tricycle, bicycle or scooter. Scooter is my favorite, I love it because one limb has to do one thing and another limb has to do something completely different. One limb is in balance and one limb is active. Let's challenge ourselves like Mariah talked about, the affordances. I'm going to switch now. Often I'll get my kiddo will say that they don't want to switch. They tell me no. Is it because of weakness? More than likely, but the weakness impacts our ability to learn and try to practice. Again, we've talked about sometimes they need to be exposed to skill to trial and learn. They need to learn and their body just isn't gonna suddenly pick it up. So that's where you wanna think about the brain has to be ready but we have to be ready to learn and put it all together.

Again, postural milestones. As they get older, you're gonna see more of that slouching, that restless behavior. This is where I often get that as a PT I get that my child won't sit still but I can't just act in isolation. I have to consider the other aspects that are involved from that sensory standpoint. Do they understand when you say, "Sit up?" Do they even know what that means? So we'll watch my sweet little friend here. I gave her the cue to skip. I did not demonstrate it, I waited for her. One thing that I especially like to do is I take away the visual demonstration, I ask them. And what Mariah spoke about mirroring back. I was telling her, "I see you're hopping on one foot. I see you hopped on the other." I'm giving her kind of that feedback of what is her body doing? So I'm saying back to her, "All right, let's skip." She tries to do that. And I say, "Well, I see that you use two feet together." And she recognized that maybe that wasn't quite what she wanted. And I said, "Oh, I see that you stepped on one foot." Again I'm mirroring it back to her. I may take it up to where I demonstrate it back. But again, I'm meeting her where her body is. Where is her access to her environment, where is she

ready to perceive that learning opportunity? So this little girl, she's a little higher level. You'll see that I've got her doing multiple things together here. So she's gonna try to do some hopscotch. See, she understands she's avoiding. And we get stuck. She comes back and we're able to do it. So what you're seeing here is as she plans through this, again, you don't wanna stop and say, "Well, they don't like it, or they're distracted, and that's why they're not doing it." Sometimes they're not doing it because it's taking the time for the signal to get to them and their body to react and their body to learn. Again, when we think, "Where is my body? What step do I have to do next?" This little one frequently pauses and then goes, "Oh yeah," because she's remembering this step now. So again, thinking of that praxis theory, thinking of how everything has to come in order, sometimes I just have to cue her, "I see you jumped." And then she goes, "Oh yeah." And she remembers the next part. So as we get older, this is where we're gonna see some of those gait abnormalities come in a little bit more.

Again, I get the frequent where they're clumsy, frequent falling, running into people, places or objects or running into walls, cutting corners too fast. 'Cause they don't know where their body is. Is it because their balance is off? Probably, but is it also because they have no idea that that wall was a lot closer than they perceive, because they don't know. We're gonna see the emergence of some of that single limb balance, the lack of body awareness, that limited ankle strength and core strength because we haven't necessarily challenged our balance to this point yet. And now we're trying to perceive it. And again, what Mariah talked about that feed-forward. How do I react now? Because someone just walked past me and now I'm gonna fall over. Now the next time, now more people walk past me, what do I need to do? Because I can give all the feedback in the world. I can tell them what they did after the fact, but they may not retain that. So how do you direct that learning opportunity to them? How do you cater your interventions to meet them where they are? Why is that important? Toe walking. Again, that's this whole separate kind of course but really what we wanna touch on here is that you're seeing a consistent presentation that beyond two years of

age they're walking on this tip toes, is it because of sensory avoidance? Is it because they don't understand when you say feet flat or are they limited in a verbal or non-verbal communication style? So you talking to them, you could talk to them all day long and they still won't understand. So what are other ways that you can intervene to help them learn? As we look here a little bit older, so that teen to young adults. This is where we're seeing like you're clumsy well beyond the point that you should. We're gonna see still that continued poor balance. Often we'll hear that the child has to sit to put on their pants. Again, as a PT I'm still gonna key into that because they don't have the functional single limb balance to be able to do that. And now the parent is frustrated because the kiddo is 15 years old. They can't lean on them anymore. How do I help them? Is my expectation to help them stand on one foot, maybe, maybe not. But my expectation might be to help them understand to hold their core up while mom helps them or whatever it is their participation level. As they get older this is where we're really gonna see they've learned their baseline skills. They've kind of gotten to a point where they can jump, they can run, but how do I put it together?

So this is we're gonna see that poor physical endurance and avoidance of physical activity. The lack of inclusion in team sports, social, motor planning, and taking everything in. Are we too aggressive, or we just don't care? And so that's where we wanna see. But through all of that we now have a secondary diagnosis that is coming through in waves now within physical therapy for obesity, because we don't understand the importance of health and wellness. A lot of my older kids my plan for them is I teach them health and wellness. I teach them, they come in, by the time they're discharged my older ones with kind of a higher cognitive ability to be included. By the time they leave they are telling me how to run a PT session. We have a warmup, we have our activity and we have our cool down. And they can tell me how frequently, how long those activities should be. Even my kiddos with the ability that maybe they can't necessarily provide those services for themselves. By the time they're done, they have an ATP that they can flip through and they can recognize and they will participate alongside the parent. What is participation? It's not just the patient, it's also the parent.

How do you get them together? Gross motor is important, let's not just stop because the kiddo can walk. So again, what are the important things to remember? We're gonna talk about the rhythmicity. How do we move? How do we organize ourself for balance and body awareness? How do we come together? And you can see these things here but from each perspective, what we want to look at is that praxis is that ability to respond adaptively and appropriately in a meaningful and efficient way like Mariah said, "Is how do we put all this together?" We have the idea of the action, the organization, and then how do we execute it? We're gonna face challenges with our patients with ASD for that general dyspraxia. How does that affect their milestones and their challenges in ADLs and play? How do they take in their sensory system and their posture? We're gonna have difficulties in some basic gross motor skills and the interpersonal synchronization because how do we play with our peers appropriately and playfully within those opportunities? So again, we're putting this all together. We say daily life and play because everything for a kid is that, how do we bring it all together? We've got our motor theories. Now we've understanding now that children with ASD have these affects in their motor development. And here's some ideas of how it's affected and how these theories play together. So we're gonna come together and we're gonna figure out what is it that we can do as professionals to help them. And how can we help them with their home exercise programs? Again, the references are separate. I'll let Mariah have any closing thoughts for you as well.

- I'm good. Yeah, I hope all of that made sense. Like I said, it was a crash course into praxis and there's lots of resources about praxis out there, and I hope you take advantage of some of them. Again, please feel free to email us. This is our email. There might be lots of questions, there might not be. I hope some of it made sense, even if you need to brainstorm with us, we'll be happy to do that.

- [Fawn] Thank you so much Mariah and Lisa for a great talk on daily life and play. Our next session will be impacted motor learning, clinical evaluations, assessments, and interventions.