Impact of Motor Learning: Foundations of ASD and Motor Learning Theories

Recorded Aug 24, 2020

Presenters: Lisa J. Roehl, PT, DPT, Board-Certified Clinical Specialist in Pediatric Physical Therapy; Mariah Woody, OTR/L

PhysicalTherapy.com Course #3872

- [Narrator] Welcome everyone to continued and occupational therapy.com. Today's course is going to be a three part four hour masterclass on the impact of motor learning for the child with autism spectrum disorder. Part one will be on the foundations of ASD and motor learning theories. Our presenters today are Lisa Roehl and Mariah Woody. Lisa is a physical therapist with 10 years of experience in pediatrics. She received her doctorate of physical therapy degree from the University of South Carolina in 2009. Lisa has worked with an outpatient pediatric clinic serving a variety of patient populations and ages. She is trained in TheraSuit and TheraSuit method with the provision of an intensive therapy model for children with neurological disorders from 2011 to 2013 in Columbia, South Carolina. She specializes in the neurological population and early motor reflex integration. Lisa became a board certified specialist in pediatric physical therapy in 2019 and currently works in Greenville, South Carolina at Advanced Therapy Solutions Kids. Mariah is a graduate of the Medical University of South Carolina and grew up in Kentucky. She is a former applied behavior analysis therapist for children with autism and that is how she fell in love with occupational therapy. She is an interactive metronome provider and integrated listening systems provider and a Kinesio Taping practitioner. She is trained in neuro developmental techniques for the adult and pediatric populations, reflex integration and also heavily trained in cranial sacral therapy. She was the South Carolina Occupational Therapy Association President from 2018 to 2020. She has passions in reflex integration, praxis visual deficits, cranial sacral therapy and neuro rehabilitation. She loves living in South Carolina with her husband, son and dog. Welcome to both of you and Lisa, you can go ahead and get started.

- Thank you for coming today, our course will be on the impact of motor learning foundations of ASD and motor learning theories. You can read our disclosures here. All social media in terms of photography and videos and any case study information has been provided with permission from those families. What we are going to be learning today is our learning outcomes. The participants will be able to recognize the statistics of ASD including prevalence, general characteristics and medical diagnosis criteria.

Participants will be able to identify at least three motor learning theories. Participants will be able to identify at least three areas of focus within both occupational and physical therapy for the child with ASD, including sensory, fine and gross motor needs specific to this population. Participants will be able to identify how at least three different ways of motor coordination is impaired for the child with ASD and its effects for the body to perform functional tasks. What we wanna do is start us off with a baseline knowledge of autism spectrum disorder and its prevalence, how often are we seeing it? The Center for Developmental Services Autism and Developmental Disabilities Monitoring Network, ADDM is the only collaborative network that helps us track the numbers and characteristics of children with ASD. What they do is they look across multiple communities and come up with the ideas of general characteristics and prevalence so that we can adjust that information to help us learn. General statistics say about one in 54 or 1.85% of children have been identified with ASD, according to this survey in 2016.

Other criteria show us one in about 68. Boys are more than four times as likely to be identified with ASD than girls. In 2020 a healthy goal of increasing the percentage of children with ASD who received their first developmental evaluation by 36 months. What we want to see here is that generally across the population characteristics are noted however, a formal diagnosis and evaluation is not being achieved until 36 months or older. About 18% of non-Hispanic white, about a non-Hispanic black and Asian/Pacific Islander children have autism. So we're seeing kind of a prevalence there. What we see is it's lower in Hispanic children about 15%. Again, that prevalence of ASD has varied considerably over the years. Some of that has been due to how do we diagnose this and how do we see this? We're gonna see a higher than previous estimates from 2014 on. Again what we want to see here is so that we all understand how the diagnosis of autism is achieved. We as occupational or physical therapists are not the ones providing that diagnosis. However, we are the ones working within those diagnosis criteria. We wanna see is the golden standard for creating that diagnosis is the ADOS or autism diagnosis observation schedule. What we see here is an evolved

semi-structured play-based activities for assessing the social interactions and repetitive and restrictive behaviors of children. What they do is they score this on a scale of one to 10 to gauge the severity of the disorder, with higher scores indicating a greater severity. A child must have persistent deficits in each of the three areas of social communication and interaction plus at least two or four types of restricted or repetitive behaviors. As we look here, those persistent deficits in social communication and social interactions across multiple contexts. We're looking at deficits in social-emotional, deficits in nonverbal communication behaviors used for social interactions, and deficits in developing and maintaining to understand relationships.

So again, this is to bring us all to understand what is it that we're seeing when we look at the diagnosis of autism? We see these repetitive and restricted behaviors, that is kind of the stereotypical thing that we think of. We're gonna see that behavior interest become a little stereotyped, or repetitive motor movements. We might see them perseverate or get stuck on the idea of the use of an object or maybe even speech. And we're gonna see that insistence on sameness, and the inflexibility to adhere to different routines. And so what you're gonna see is kind of that rigid, maybe a ritualized pattern for verbal or nonverbal behavior. We're gonna see some characteristics that are highly restricted, okay. We're gonna see some fixated interests that are abnormal in intensity or focus. So we might see someone be interested in the topic that in and of itself is not necessarily for ASD, but what we see is that heightened focus, where they are unable to move away from that task or activity. We're gonna see a hyper or hyporeactivity to sensory input. Maybe we're low arousal and we can't get excited about things, we have a flat affect. But we also might see a very hyper, again, that increased emotional response to an activity that otherwise may not have induced that type of response. What we see here is that a lot of these symptoms and display of behaviors present early in the developmental period. These activities may be within a developmental range, and become heightened as the social demands increase beyond their capacity. So when you're little it might be okay to use less verbal knowledge for things. But as you get older, that verbalization should increase. We also see the

symptoms can cause this clinically significant impairment in social, occupational or other important areas of functioning. So what we're seeing here is that the symptoms are causing an impairment, beyond what can be explained by maybe a comorbidity. So whether it's beyond an intellectual deficit or beyond a global delay. So again, how does this process start? We kind of know the criteria for it. But how do we get a child to this point? What is the process? What we're gonna see is these children have experienced a developmental monitoring period, whether that's from teachers, from schools, from parents. They are going to kind of assess this and look for it. They're gonna look for some of those early signs. Some of the early signs are the avoiding eye contact, having little interest in children or caretakers, maybe not going to other people and not understanding the social demands outside of their comfort. They're gonna have a limited display of language, maybe they'll have fewer words than their peers, or they get upset with the use of words or communication. You might also see that they have some upset moments in that change in routine again, this may be monitored as the child is younger.

As we get to this screening, a developmental screening is done by a behavioral specialist or advanced position. So you're looking at your physicians. And what they're gonna do here is they're gonna use tools to screen those behaviors and development. We're gonna be looking at language, movement, thinking, behavior and emotions. That screening again is done by a doctor or a nurse or other professionals in the healthcare. The formal evaluation which we talked about through the ADOS is what provides the formal diagnosis. ASD symptoms can be seen in 18 months or younger, again with some of this changes in behaviors compared to peers. However, a formal evaluation diagnosis is not done till later, as we heard before, that we're looking to lower that age range, so it's about 36 months old. By the age of two, we can see that you're gonna start to see a little bit more of that screening, a little bit more you may see some early evaluations depending on the severity, okay. Some of that access to our health care in our environment, you might see some discrepancies for black children as well as Hispanic children being diagnosed formally. So as we look at this, we've now come to

an understanding of what ASD is, what is autism as we look across the spectrum, and the impact of this course here, is to talk about motor learning. So we're gonna look at the motor learning aspects for children with ASD. So what is motor learning? A motor program is referring to the stereotypic attributes of complex movement that persist as those parameters change. What does that mean? Well, what are looking at is the framework of why we do what we do. If we go to walk, we have a certain basis of information we're going to do, and that is the motor program. If we go to skip, there is a certain framework that we have to do to skip or to do that activity and that is what the motor program is. How did we develop that motor program? And that's what we're gonna be talking about some of the different theories with that. Some of these motor symptoms causing that change in the motor program are some of the earliest identifiable impairments in children, especially those with ASD. We can see here 50 to 85% of children with ASD demonstrate consistent deficits in several areas.

So again, we're looking for that persistence, that consistency. It's not a one time change in activity, it's not like maybe you were going through a phase, it's where we're unable to get past that where we need to teach more and we need to understand more, okay. We're gonna see 70 to 75% of children with ASD demonstrate a co-occurring moderate to severe intellectual deficit. So we're gonna see some of that playing into it as well. Again, the symptoms and activities and diagnosis criteria of ASD is beyond that, that can be explained with another diagnosis. So when we compare to our typically developing counterparts and our peers, childrens with ASD have a universal difficulties in the following, gross and fine motor performance, aspects of praxis during performance of sequential or imitation based activities. The coordination of two sides of the body and rhythmic upper and lower limb tasks, and social motor coordination, okay. So what we're gonna see here is it affects all areas of development, that motor learning basis. So what we wanna see here in this video, we're gonna look at this girl, I'm gonna let you watch it and then we'll rewind it. So we can see here that she whoops, sorry that she climbs up and let's watch it again and let's talk through it. What do we see here? Here we go. So Ashley climbs up, what we

can see is we talked about the upper and lower limb. So we can see she's struggling to kind of get her lower limbs together. She reverts to one side with her upper body. She's struggling to figure out how to get up. She's doing some repetitive motions, not quite understanding that if I lean to one side that I'm gonna have difficulty to get over. So we can see here some of that motor planning deficits. So how do we learn this? What develops? What is the science behind how we have a motor program? So one of the theories is maturational-based. So this is just referring to your body grows. So we're looking at this central nervous system, and it controls our motor development in a pre-determined way. So we're looking at the neurons, we need to fire your brain developing, how your muscles learn through neurological science.

So we're gonna see a linear developmental pattern, certain predictable changes during that neuronal maturation are at the point of behavior development. So as we grow is based on our body naturally developing on the natural nerve systems growing and so through that we can predict that certain changes happen at certain times. The theory directs that the level of autism severity is related to the lower development of the central nervous system. So what we see here is a lot of times this is that reflects patterning of development, that unless we grow and the brain and body develop, that we are unable to achieve later point. So what you're seeing here is that certain steps have to happen to get to the next. So when we look at reflexes, this could be about that reflex of elements a poorly integrated reflexes indicate poorly acquired or early motor milestone development. And so ultimately, because those reflexes are not becoming integrated the way that it should, we're looking at motor development issues later. So what we see is as you're younger that involuntary reflexes they mature. So when you're younger, they're going to be a state of where that reflex automatically responds. As you develop and it begins to integrate, it's only gonna respond to a conditioned response. So maybe you startle. I startle when someone comes in suddenly, but that shows that I can control and I don't startle when something is not perceived to truly be dangerous. Children with mature reflexes can maintain their posture and movement and use those motor patterns as they need. They don't have to

think about it, it's integrated. Those with immature hyper active reflexes must work hard to control that response and to integrate it in that it is hard for them to take the signal together. And so what you see here is that, again, that lower level of nerve system in developing to the higher brain so how does this grow together? It's in linear predictable pattern. So reflex circuit training is what helps us to move forward. So what we're going to do through reflex training is we're gonna train the lower systems first, and build. So again, with this, we're looking distinctly at the central nervous system, and how it develops in a pre-determined way. So we can look here at this young boy. And the moment that, that limb raises up, he onsets that ATNR so we can even watch that again. As he lifts up. And there's the ATNR it automatically controls the movement. And we can see another example here of this young girl, which you'll see is that STNR. And again, we're not necessarily worried about what the reflexes are, but we're concerned that the reflexes haven't integrated in to allow further progressive movement.

So we can see as she climbs in, as she comes in, her body collapses forward, it's difficult for her to change how the upper body is moving in relation to the lower body because of that predictable developmental pattern. She must flex in through an STNR reflex pattern, because her body hasn't been able to progress past that at this point. So there's other theories of motor control. The next generalized theory is learning-based. Learning-based is based on trial and error. Motor skills are learned and skills emerge as those repeating actions are rewarded. So this is where we're looking at our body awareness. Motor development is a function of learning rules to evaluate, correct and update memory traces. So again, when we talked before about that motor program, that framework, here what we're saying is that framework is learned. A child learns not to step down from something but to crawl, cause maybe they might fall. And they've tried it several times because they keep falling and they learn different ways. The idea is that they are evaluating, and they're modifying their reactions, and they're updating that memory frame. So they're looking at recalling that recognition and that imitation. We'll get more into this in the second course, as we talk about praxis. But

again, it's that learning how does our body adapt to movement? A lot of times it's this ideas that task and skill specific basis, is what utilizes past movement recall. So what does that mean? Where we're looking is that you have done an activity and now you're learning from that because you've repeated it, and you're recalling that previous. You fell when you tripped down the stair so the next time you're gonna take it slower, you're going to step with more control, you're going to think about what happened before to gauge how you're looking and moving now. What we see with this is it a lack of exposure or limited practice of a skill that can lead to a deficit. So as we think of our kiddos with autism, have they been exposed to a skill, have they had the chance to practice? Do they need to practice more than a typically developing peer? So that is where we want to show is that maybe they just don't pick up on it by watching somebody alone, they need to practice it, they need to feel it and move it themselves.

So the practice of a task with specific boundaries and feedback controlled is what can give someone the best learning. So again, you're creating an environment where they can isolate out what they've learned. All of us do, some we teach kids and our children how to eat, we give them a certain boundary of what they need to do. They know now they have the tool to try and bring food to their mouth, they're gonna practice with that, and determine what is the best way for them to learn through that trial and error through learning. So what we can see here for this little girl, as she goes through. So we're gonna watch that she realizes that there's Velcro on the ball. And let's watch what she does as she plays. We can see she recognized that the ball stayed when she threw it. So now she's picking up something else it's a little bit different. And she's learning her interaction. So I wanna take us back through this. When I set her up on this activity, the only cue I gave her was to play with the balls. I did not tell her how they worked, I did not give her any boundaries, I wanted her to figure it out. And what you can see here is in the beginning, she realizes that it sticks. She takes a second one and throws it and it works. When the parameters are changed, she does the same pattern to throw it. It doesn't stick, what she actually determines is that there is a small piece of Velcro. And she started to figure

out what was the best way for that to attach. It's a different activity, it's a different ball, it's a square, it's a little different. So we can see here she learned by trial and error, she practiced that. So as we combine these we look at your dynamic base. So this is the interaction of the brain, body and environment so all of it together. This is gonna be non-linear development, we're gonna see the emergence of behaviors dependent on the task and environment. This explains why development by a process in which different components interact with each other to result in a change. So what you're seeing there is it's the reflexes coming together. It's the trial and error it's the learning. And through that, we're gonna have some predictable points. So that's where we get kind of how do we know that at this age, that's when a kiddo learns how to skip. That's when a kid learns how to button their shirt, they're putting things together. Obviously their brain has to be developed to get to that point of higher motor learning. But how do we help them come together on it? And so this is that theory of that dynamic base, that everything plays a component.

So we're looking at the influences of the central nervous system and the environment. Have we had an opportunity to practice? Have we been exposed to the task? And is our body and brain ready to learn the task? Infants learn to select strategies from that motor repertoire. So they've got their toolbox, and they're growing from that toolbox. That's where typically you should see a child pick up that maybe they have played over here in this circumstance and now it's a different circumstance and they're figuring out what to do. Can they relate, can they carry over? And what you might start to see is in children with ASD that, that carry over and that processing is harder for them to understand. So what we want to take back and take in consideration is how is the body learning? Where is the need in their motor learning program? So this is where with dynamic basis the emphasis on multiple environmental circumstances we're not only going to be looking at one setting, one isolated situation, we're going to expose them typically developing or not to multiple environments and multiple scenarios so that their body can learn and put that all together. So why is this important? So we need to take a step back and look at this altogether. So when we look at the

International Classification of Function, Children and Youth so the ICF model. So we're learning about motor learning theories, and how it all comes together. But let's talk about what does each component mean. If we say that it's reflexes if we say that it is the motor learning, how does that come together for us? How do we put that all together? And so when we look at the ICF model, this can help us kind of understand where it is that we need to help the child. The ICF model breaks it down, most of us know this programming of body functions. So the physiological functions of the body systems, body structures, the anatomical parts of the body. Activities, so that's the execution of that task. So standing on one foot, that is the activity. Participation is how do we involve this in our life situation? How do we use this and function in our every day? And then we also look at the environmental factors that come alongside that. So again, where is the deficit? And what is it that we are trying to do? How do we build a program? Are we looking at function, structure, activity or participation? How does that all play together for the child with ASD?

So what we're looking at here is that ICF model helps us translate from those body functions and structures to move more towards activities and participation. We're gonna look at that child-centered approach to more context focused so we can look at the family, okay. So as we work with a child, and as we see what is important to them, we wanna also span across their environment. If that child can do something in isolation, we have taught them that within specific boundaries, how do we help them use that in their environment? Their brain and their body is now ready to learn, how do we help them use that within activities. So what we're gonna see here is that ICF model can help us guide our interventions and strength assessments. So we're gonna look beyond just the body structures and functions. We're gonna put this all together. There is a developing core set of ICF protocol and impairments for ASD that is in development. So you can have access to that. And if you look this up, you can see based on our references, that there are some opportunities for that core list is being developed for those children with ASD. So as we put this all together, how does this affect us within the pediatric environment? So pediatric therapy is the incorporation of

enriched environments. We want to stimulate the brain and development by optimizing those periods of neuroplasticity. When is the brain and body ready based on maturational? When is the brain and body ready based on learning? And how do we put it all together? So all this comes together to direct us to more of a functional approach, we're aiming to transfer those motor activities into daily life. Let's take those structures, let's take those functions and put it into an activity and participation level. When we look at this we see that there's beyond the cognitive functions that are affected in children with ASD. We see that they have motor coordination, they've got other systematic approaches to what's affecting their participation. And what we want to take from all this is now you know the prevalence of ASD, now you know motor learning theories. But how do we put all that together and best practice is to put it together to help the child reach their environment. So these studies is very sized to emphasize the importance of conducting multidisciplinary assessments and that's where this program developed between an OT and a PT and we loved it. Speech involved as well as other disciplines to come together for the treatment of a child with ASD. Neither the child, the family or therapist acts in isolation they all act together. So how the individual functions can be improved by instead of looking to change the individual, but enhancing the environment and reducing the barriers around them. A lot of times children with ASD have very significant memory and attention. They have great attention to details and intense focus. How can we help the individual recognize these as strengths and utilize this in their participation? Is this a way that they like to practice things? Will it set them up for learning within that environment of what helps them learn best.

- So what we're gonna to take a look at next is the ways that motor coordination is impaired with autism spectrum disorder. So think about how a child typically interacts with their environment. They're not just waking up, going to school, coming home and having meals, we know that. It's very much a social implication as well. So I put this picture on here of my family. And essentially, what we're looking at is can they coordinate their body to play a simple game? Can they understand what their body is

doing to play Twister and understand oh, that person's over there, I'm about to run into them, or am I completely oblivious to my environment, and I'm just gonna crash into whoever is around me. We have to learn coordination by imitation. There's a lot of research out there that shows one of the best ways for a child to learn how to expand their motor coordination is by us imitating them. Because what they're finding neurologically is that there's a distinct difference between the cerebellum and the cortex, and that for some reason, those neurons aren't always firing together. So having more of that visual representation, to a child helps, again, fire a little bit more of those neurons to say, oh this is what my body just did. I wonder if it can do this and I wonder if it can do this. Again, bringing it back to some cause effect. Children with ASD also have issues with rhythmicity and fluidity in their movement. If you put a child who has some motor coordination challenges and have them do jumping jacks versus somebody that's more neurotypical, the fluidity, the timing, the sequencing of it, it's just different, it's a little less robotic.

Again, it's just more fluid, all in its movements, because they're putting all of these sequences together. Bilateral coordination it effects their climbing, their ability to write, their ability to do buttons, tie their shoes. Turn a key, open a door handle, jump rope, be able to get a basketball down from a shelf for them to go play basketball with their peers. A lot of it is very interpersonal, for their motor coordination. Because as Lisa brought up, it's how do they access their environment? And we access our environment with movement, and movement leads to so many other things within our life. So taking it away from structured tasks, I mean, can kids enjoy their time with other peers? Can they have a dance party? Can they play Twister? Can they do a board game? Do they have access to their needs? So if they're thirsty, do they have the motor coordination to be able to go and get a bottle of juice and open it and then pour it in a cup. If you think about it and you break it down, that can be very, very, very challenging with some of our kids. So this next slide is going to show something, we're gonna wait for the slide to catch up. There we go. So it's the pyramid of learning. Alright, so I've typed it out here. But what I want you all to do is I want you to click this

link at the bottom of the page. And during our presentation, I want you to keep it with you because we're gonna be referencing this more and more and more. And this goes back to one of the models that Lisa brought up is look at the very bottom, it's reflexes, okay, and then comes sensory, and then comes motor. And then comes sensory motor perceptual ability. And so depending on which theory you're addressing, we might be giving some of our kids levels that are too high when the issue is actually much lower. So this is probably a very important slide for me when I'm gonna be talking because I'm gonna be referencing this hierarchy a lot. One of the reasons that reflexes can be so harped on in treatments is because if you go back to in utero development, they have reflexes before they even have sensory perception. And so a lot of people will argue that the reflexes in the sensory will go together. So you certainly have to take a look at some of these things.

So keep this with you. We're gonna keep on referencing it. Where I'm coming in as an occupational therapist, I'm gonna be talking more about how motor coordination influences OT treatment. And also bridging the gap with OT and PT and how we work together as a team. So, we have our general fine motor impairments. A lot of people think that OTs do just fine motor skills. We don't obviously but if we break it down here, manual dexterity, object manipulation, how do you play with novel toys? If we presented some buttons to a child or something with little beads and twist off caps, do they have the knowledge and the motor base to understand and how to interact with their environment. And even if they know what to do, do they have the coordination to twist off a cap and be successful at it and find enjoyment with these activities? Posture. Posture is a big one. And it's not just necessarily sitting up straight, it's having the muscle tone, and the breath support and the alertness to be able to sit up. What do they need to be able to maintain an alert posture so that they can bring their hands to mouth or are they gonna slump and lose their breath and lose their alertness and lose their control? I can't tell you how many children I see that probably for the first couple months, if the posture is off, we don't work on anything else except for posture. And then we start to see these other natural skills of eye hand coordination even in infants,

reaching for a toy and then coming back to the mouth without completely losing our body control. It's very, very, very important. Actually, if you'll go back one, thank you. And what I have here is actually a picture of my son. This picture he's 14 months old. And it is his very first time handling a cardboard cap, okay. But he has the previous motor learning of, I've handled a spoon before, I've handled a cap before. I think I know what to do here. And these are things that we hope for our children to be able to take and use with their motor coordination is take their other reference points, other tools and be able to apply it to a novel scenario to be able to be functional in their life. If you notice his posture, he's sitting up straight. No, shame on me. I don't have his feet supported. But he can still hold his body well enough to effectively coordinate that spoon coming to his mouth. He can scoop ish granted, he's 14 months old, and then he can bring it to his mouth, okay. Again, that posture is crucial for having our children interact with their bodies a little bit more appropriately. Good, okay.

Other impairments, play exploration. This very bottom photo, kids are starting to learn about their bodies. If I fit, can I sit in it? Can I interact with this box in lots of different ways? This bowl, can it go on my head? Or is it just for me to eat out of? How can I appropriately explore with my environment? And not only that, oh, look dad's imitating me. Wow, this ended up being a fun interpersonal activity. There's other sensory components again, that body exploration, that body schema that being able to tolerate things on various parts of our bodies is having our body interact with various parts of our environment, and tolerating it and making sense of it. I liked that I didn't like this. How can I modulate my body together? Behavioral outcomes due to motor incoordination. This one's a pretty big deal. We don't always think that behavior is an outcome of motor coordination. But if experimenting with toys is mostly frustrating, is it limiting and therefore fun and exciting? No, we're going to be constantly reaching barriers and reaching barriers. And so then we have these behavior outcomes that teach us other people can do things in our environment better than we can. And so we're gonna talk about this later but that's where our treatment strategies come in. At meeting them appropriately in that pyramid of learning scheme of where are they

successful and how can we build on that? So that they find joy, they find an activity to be exciting and successful and want to build on top of that naturally. Otherwise, we're just hitting them over the head again and again and again, with something that is challenging and not fun. So are we giving them activities that they want to practice. Lisa brought up a really great video of a little girl playing with a ball. She was successful at something so then she started taking a new object all on her own, and she wanted to practice it and she wanted to figure it out and her own motor coordination started to blossom a little bit more. So they might always not have the language to communicate their needs to meet their motor coordination and their desires together. So that's where we come in. And then obviously for occupational therapy, we deal with some visual skills. This is a broad subject all on its own. Is it eye hand coordination? Is it perceptual? Is it spatial reasoning? All of that goes into some of those sensory components. And based on one of the models, some people would argue, oh if their reflexes weren't developed how could they develop some of these other things? And there's certainly an argument to be made for that. But I think you have to consider all of the models of development to find the answer for your specific child.

Next, we're gonna talk more about sensory integration, the over or under responder. The over responder might look like, if they are sensitive to touch, do they withdraw or do they act out? And if they act out that's more of an over responder. This is a very, very big topic. So I'm really just gonna touch base and probably not do it enough justice so keep that in mind. This could be a whole course on its own about sensory integration and motor coordination for sure. So the tactile sensitive child, might over respond by having a meltdown, the under responder might withdraw, or they might seek it a little bit more. There's also an argument to be made that the over responder could withdraw, because it was too much so I'm gonna over respond by completely withdrawing. The sensory avoider and seeker that's also where that comes in. An over response can be a term of avoider, the secret can be I want more of that. Sensory processing, the modulation, discrimination and processing. The modulation is more of

can I ride this wave of sensory processing? If I start to get a little bit too heightened can I use calming strategies to bring it back down? A lot of our children with autism have a difficult time with modulation. And if they have a difficult time with modulation, they might also have a difficult time with discrimination. Of I'm throwing too hard here. This is too forceful, or I didn't use enough force in putting these things together. And then that comes into our overall processing of how do I make sense of all this information? How do I organize this and input it and take it back out into the world? Body scheme and awareness. Body scheme is more of how does my body interact with the environment, okay? I know where my body is, right here. I know that I am squeezing my hands right now okay, and nothing's happening. But awareness is knowing over here that Lisa is sitting right next to me.

So when I get up out of the chair, I'm not gonna go swinging that way. I know she's over there. Because I know where my body is, I know where her body is. And I can coordinate within that realm. A few other tag along thoughts. I'm working with a few kids right now that we could talk about all this sensory integration and sensory processing, but the truth is, is do they trust their body? Do they trust their body enough to coordinate it? Or are they dealing with some sensory processing that they're a little bit afraid to coordinate their body even if they could? Do they understand what it feels like? So when we ask them to stand on one foot, or to reach, do they understand what their body feels like? Can they feel that stretch that happens when they go and they reach up for a light? Do they understand what it feels like to hold a ball and to bounce a ball? And do they understand if I bounce this ball, what did their body just do to interact with the environment? Can they make sense of it to be able to reproduce it again? And this all goes back to the activities and the participation level. Can they take all of this motor coordination and all this information that their brain is receiving? And then can they go to a higher level skill? Again, that pyramid of learning? Can they take this all the way up to the top to think about executive functioning? What is my self esteem like? Imagine interacting with your environment and constantly feeling like a failure, what would your self esteem be like with the world around you? How would you

want to engage with your peers if you constantly struggle with every single thing that you have your body do? I don't think I need to read off the slide but the big takeaway is, where do they find joy? How do we help them find joy and how they use their body? Because that's ultimately what's going to get that personal relationship. And that personal relationship is what helps some of this motor coordination blossom.

- So as we kind of develop this further, within physical therapy, again, OT kind of that stereotypical fine motor again, it's more than that. But PT is more than just our basic gross motor impairments. So we're gonna also be considering postural control, we're also gonna be considering some of that bilateral coordination but when we look at it through gross motor movements, is the body able to sit up? Do we recognize that we're sitting up? Are we seeking other ways because we dislike some of that input? Are we avoiding it again because maybe we don't wanna take in our environment again, what is our ability to participate? Our bilateral coordination is very key in early developmental milestones importance, again, that rolling and crawling, Are they aware of how they are moving? Are they limited because they need to see it, and they need to be taught the activity. Typical development is that the child kind of learns by exposure within their environment. If my toy is not next to me, I may have to roll to get that toy, I may have to find a way to get there. And I'm motivated, I want to interact with it. But if we take in consideration, some of the motor planning and some of the learning is our body and brain ready, maybe we have had a difficulty interacting with that toy. We don't know the importance of that toy, we don't understand why should I play with it? Why is that entertaining to me, so now I am not motivated to move towards it, I do not seek out the ability to crawl towards it. Because crawling is really hard for me to get my upper and lower body together. Rolling is really difficult for me because I have to flex and I have to extend and I don't really like that vestibular input. And so what we may see again, is some of those early motor milestones are lagging, or they have to be taught because the child doesn't naturally pick up on those things. So as we kind of progress, the kind of the older child, we may see some gait abnormality, some of that toe walking, which is a class in and of itself. But really what you're seeing there is it

sensory, is it motor learning, is it strength, is that I don't know how to move my ankle? You may see some intoeing, some overpronators and some of that comes in regards to high tone, low tone. That is something that comes in again, whether you have ASD or maybe something else. Again, you're looking at something that's offsetting your muscle's offsetting how you coordinate within your environment. Is our muscle tone low because we have not had enough exposure to practice these things? So intoeing often happens, because the child will tend to W-sit are we W-sitting because we aren't sure how to hold up our posture. So we sit in that locked out position. So a lot of things can play together. But you may see some of those gait abnormalities. Mobility, I want you to take your mind from mobility beyond just gait and physical endurance. Walking is mobility, yes, but there is more to mobility. How do I move in my environment? It may be crawling, it may be using a bicycle, it may be using a tricycle, it may be hiking with my family, going up and down the stairs, playing on a playground, mobility is more than just walking.

So what we wanna look at is what is the cause of why they are limiting themselves through regular ambulation or mobility? Is it because their sensory system doesn't like that fast movement of going down the slide in a playground? Is it because to be more upright on a bike and that sensory perception of something coming past me and now I might fall, the balance and all that coming together? Because maybe I haven't learned that if I fall, I can get back up and I can learn from it. Is that trial and error, that learning process affected? Is it hard for us to figure it out? Are we able to keep up with our peers and our family? Can we do it in the home? Can we simply go up and down the stairs in our house? If I can't get up down the stairs to my house cause it's too much work for me to think of my legs have to move, I still wanna carry something I'm finding a deficit to get to where I want to go. Now I'm not motivated. Now I'm agitated and now I don't care to do that activity. So again, bringing it all together. OT and PT is more than just fine motor, gross motor. It's that level again thinking about two activities and participation. How is motor learning that impact of our motor and our body moving together affecting our interaction with our environment. So again, all therapies play

together. So when we look at this we're gonna kind of talk about this throughout this course talking about how this all kind of plays together. I'll speak a little bit and let Mariah speak a little bit from her perspective of how both therapies play together. But really what we're looking for is we're kind of taking it all together that how does your body imitate? How do you play? How do you move? How do you have access to your environment? So we can see this little boy in this picture here, he's climbing this is a great family that they actually through COVID-19 built this playground at their house, so that this little boy with autism could have exposure to a continued playground. What was great is they asked for their OT and PT to help them decide what it is that he needed. And through that you can see that he is climbing he has access to various slides, various heights and perspective. And so together, we are able to adjust for this child that from a PT perspective, yes, he is mobile, yes he walks, yes he learned how to crawl on time. But he is now five years old and we're struggling to figure out how to move beyond that.

So again, maybe our mobility in our access is limited because it's hard for us to learn how can we set up these kiddos and help them learn? Is their body ready? Is development purely linear? There's certain aspects again, when we think back to that pyramid of learning, like Mariah said, if those reflexes are not integrated if our body is not ready, I can't take that child and put them into a soccer game with typically developing peers and anticipate them to kick the ball around taking in their environment, taking the social aspect of this kiddo is coming at me suddenly, is this perceived as dangerous? Is this a threat to me? I have to take that in. No, they're my friend, I need to move. So again, how do we play this all together? And so what you're gonna see through children with ASD is that we have to meet them where they are. But we have to help them see that maybe it's not necessarily changing the individual, but helping them realize their environment, how can we build their environment to them, so that, that motor learning process is met? How do we help them reach the reflexes that are impeding them like we saw with the boy, when we did yoga, immediately went into ATNR. I could take it from the PT perspective and say he can't stand on one foot, His

hands are kind of all over the place. But again, I have to take a step back and say, what is it that is stopping him from that movement? How do we put it all together? And that's where we can all kind of work together for these skills that we listed out. Again, looking at the motor learning theories, looking at the pyramid of learning and building upon each other to create a cohesive model, what is the importance of pediatric therapy? Pediatric therapy is not done in isolation. We're gonna bring it all together for family and function. I want us to kind of take from this, the foundations to get started from motor learning planning, as well as family and participation and how it all comes together. I'll let Mariah speak of kind of the importance from an OT perspective as well.

- So one of the things that when I do co-treats with physical therapists. I say co-treats as in like, we're treating the same child, not necessarily at the same time, is we're constantly talking about, okay, what did you do in your session, what did you do in your session? But understanding okay, what are parents primary concerns? And then what are our concerns and bridging the gap? So let's talk about the child that Lisa was doing yoga with and immediately went into ATNR. What I would wonder is okay, that's his reflex but carrying it over how is he doing with other balance? How's he doing with some eye hand coordination? Going back to infancy, how is his crawling and his rolling to begin with? Do we need to go all the way back to that phase for him to understand what his core stability is doing, what his head body dissociation is doing, then arm body dissociation? And then I also wonder, what's his postural control like? Even just sitting, even laying in his tummy going back to tummy time? And it's not to demean some of these children, it's understanding, okay, where's your cerebellum and where's your cortex? And how are they meeting cause remember, children with autism, they haven't figured out why just yet, but they know that there's a hiccup in how these two are communicating. And so we might also take a look and say, what is their fluidity like, how are they accessing their environment? I'd wanna know can he roll a ball and catch it? What can OT do to support PT with postural stability? What can we do to help him access his environment a little bit better? So if Lisa is working on a single leg balance, she's not really working on a single leg balance just to have the balance. She's saying

well, why? Why do you need single leg balance? It's usually to reach something, it's usually to climb. And then the OTs come in and say, okay, well, why do you need to climb, access your playground, get something from the closet? And then we take it level by level. So we rarely find that if something is impacting physical therapy, then it doesn't impact occupational therapy, that just never happens. So understanding what is that foundational skill? And how can you both work together to achieve it. And I would say we see the best results that way, even if the tasks themselves are very different, working on the foundational skill that these children will just start to soar cause you're meeting them at the same level at the same time. So next up, some important things to remember that Lisa will chime in on some of this as well. That autism spectrum is diagnosed through developmental monitoring, screening and a formal evaluation by a trained specialist. We've had parents come back and say that the test was pretty exhausting, because it's so long. They are very thorough with it. And compared to typically developing children, autism spectrum disorder children have universal difficulties in motor function. Some are better than others but generally speaking, all of it is impacted. And I'll let Lisa speak on the rest of it.

- So as we look at pediatric therapy, again, it's the incorporation of these enriched environments, we wanna put everything together. So again, not acting in isolation, we recognize that there's beyond services, beyond just OT and PT, and we're just focusing on that portion of it. But to appreciate that there's research out there that, that multidisciplinary assessment and treatment of ASD will create a better treatment plan and prognosis for these children. And again, the biggest thing to remember is how a child with ASD functions might be improved without changing the individual, but enhancing their environment facilitators and reducing those barriers. What is it that we can help them and their family gain access to, to utilize the things that are already there. A lot of these children do want to learn, again, that attention to detail can be used because a lot of my kiddos with ASD prefer to practice an activity they love to do one obstacle course for this session. And that's great because now they've had that opportunity to practice it. So again, as we take all this together, the key thing is to

recognize that these individuals with ASD, they have an impact on motor learning and their motor planning aspect of how they put it all together is going to affect their development. So what OTs and PTs can come in, and are recognizing those motor learning theories and that impact of motor learning for their development and how can we influence that. You can reference that we have a separate PDF document that has all our references. Again, you can see that image that Mariah linked to earlier for the pyramid of learning. As well there's some other references to some great studies that are out there, especially for the ICF model in specific to ASD. If you have any questions here is our emails, you're welcome to email us and ask us any questions or to elaborate or maybe even tease through a case study that you might have. And we thank you for attending the course number one for this impact on motor learning.

- [Narrator] Thank you to both of you for a great part one. We will now move to part two. Thank you.