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## Power to Go: Meeting the Needs of Pediatric Power Mobility Learners

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- [Calista] Our title today again is Power to Go: Meeting the Needs of Pediatric Power Mobility Learners and it's my pleasure to welcome back to physicaltherapy.com Doctor Lisa Kenyon. Doctor Kenyon is an associate professor in the Department of Physical Therapy at Grand Valley State University in Grand Rapids, Michigan. She heads the Grand Valley Power Mobility Project which is an interprofessional research and service project that provides mobility training for children and young adults who are not typically considered to be candidates for power mobility use. Doctor Kenyon presents nationally and internationally on topics related to pediatric physical therapy practice and has published multiple journal articles and book chapters pertaining to the topics in pediatrics. Doctor Kenyon currently serves on the Pediatric Specialty Council of the American Board of Physical Therapy Specialties. Thank you so much for returning to physicaltherapy.com, Doctor Kenyon, and at this time, I'm gonna give the microphone over to you.

- [Lisa] Thank you, Calista. I really appreciate the opportunity to come back and speak again on physicaltherapy.com. As Calista mentioned, today we're gonna be looking at pediatric power mobility. This is a topic that I'm very passionate about and very near and dear to my heart. So I'm looking forward to sharing with you today some of the latest research and ideas that you can incorporate into your practice. Before we start, I'd like to go over our learning outcomes. So at the completion of this course, participants will be able to: compare and contrast at least two characteristics of learners in each of the three power mobility learner groups that we'll be introducing today, identify at least four features of power mobility interventions that target learners in each of the three learner groups, so the exploratory learner, operational learner and functional learner, and again we'll be going over these groups in learning this new terminology, list at least three outcome measures that can be used with learners in each of the three learner groups, and discuss at least two appropriate expectations of

power mobility interventions for learners in each of the following learner groups, so again those exploratory, operational, and functional learners. Before I get started I would like to acknowledge the families who've given permission to show photographs and videos of their children, to use their children's first names and to describe the children's conditions and abilities during this presentation. I'm really grateful for this opportunity to be able to show you using these videos and photographs the children that I have the pleasure to work with on a regular basis. Because we have been given permission though, I do wanna make sure that everyone is mindful of the confidentiality involved and making sure that we are treating the videos and photographs of children with respect so that we don't end up seeing anything on other websites. So when we start thinking about the benefits of power mobility use for children with mobility limitations, we can really look to the literature and see many many different benefits of power mobility use.

I think for many children who are what we might call a typical candidate for power mobility use, these are the things that come to our mind right away. This is a picture, a couple pictures here, of my friend Cam. Cam is an excellent power wheelchair driver. He started when he was younger and built some skills, but he really, from the moment we tried him in a power wheelchair, he just steadily progressed his skills and really began to be able to express himself and decide where he wanted to go and what he wanted to do.

One of my favorite stories about Cam is when we were first trialing him in a power wheelchair. We didn't have a pediatric power wheelchair to try him in. So we had an adult chair that I was kind of positioning all sorts of pillows and things to help make sure he was safe and well positioned within the chair and he had done some driving outside in this manner and was doing great. So we decided to bring him in here to the university so that he would have a little bit more space. We chose a day that was kind of a quiet day, I think that might've been a weekend day so there weren't a whole lot of

people around, but that he could begin using it inside. I remember we got off the elevator and his mom and I went to the right and Cam went to the left. I remember his mom saying, "Cam, we're going this way," and he didn't have a lot of words at the time so he just was driving along laughing hysterically that he had made a decision to go a different way. Always make a big square so we both would end up in the same place, but he wanted to go the long way. I just think of that as something he'd never been able to do. What was also interesting about that is that Cam's mom was like, "Wait a minute here young man. "You need to follow my instructions and listen to me," and it was really the first time that Cam had been able to be mischievous and to kind of be a typical kid 'cause which typical kid listens to their parent all the time and follows all of their directions?

So when we kind of look at all of the benefits of power mobility use from the literature, Debbie Field and Ros Livingstone did a systematic review as published in 2014, so there's been a number of studies since then, but we can look at the ICF and see benefits for power mobility use in children, their review focused on children 18 years and younger, in the body structure and function area, activity and participation. Just to kind of highlight a few of these, we have developmental change. We have things like IQ. We have things like sleeping.

There's even been some suggestion that sleep-wake patterns and eating may be something that is impacted by power mobility use. In the activity range we have of course power wheelchair mobility and self-initiated mobility, interaction with objects and communication and cause and effect and hand use. Interactions with objects is one that I really hadn't thought about. Some work by the GoBabyGo folks has shown that a child who is typically developing interacts with a lot of objects while they're moving and children who have mobility limitations are less likely to interact with objects when they're moving because, and perhaps because, we are just kind of making a conjecture here, perhaps because they're so concentrated on the activity or maybe

they have to use their hands to hold on to a walker. Well power mobility is a way that we can help free up a child to be able to use the manual abilities that they have to interact with objects. Of course on the participation level, you have all sorts of things: peer interaction, social roles, education, responsibility. So it's just a lot of different things that children are able to accomplish using power mobility. One of the seminal studies in my work was a study by Ros Livingstone and Ginny Paleg that was again published in 2014. This was a combination systematic review of the literature and Delphi study where they reach consensus about introducing power mobility for children who have mobility limitations.

A Delphi study is something that uses different rounds of a survey with the same group to achieve this consensus electronically. In their work they found that power mobility is beneficial for children who will never walk, but also for children who have inefficient mobility or lack efficient independent mobility in early childhood, and I think these three groups are really important. As therapist we sometimes think, okay, I'm working with this little one, and I feel that the child has limited potential to use functional ambulation so maybe I start thinking about power mobility, but also should be thinking about it for those children who have inefficient mobility for whatever reason.

Maybe they have a condition that is progressive and so they're progressively becoming inefficient or maybe they're a child who it just takes a lot of energy. Maybe they're a child with cerebral palsy who can walk with a walker, or walk with Lofstrand crutches, or walk with poles, but just takes a lot of energy. Maybe they're having trouble keeping up with their peers. Maybe they're fatigued at the end of the day, but also we should be looking at those children who, for whatever reason, they're gonna walk eventually and they're gonna walk by themselves, but they just lack efficient, independent mobility in early childhood. I think about some of the children with Down syndrome that I've seen who we know they're gonna walk and we know they're gonna crawl, but we know they're gonna do it a little later. Well maybe what we can do is add some power

mobility to help them to be able to benefit from mobility while they're waiting for their independent mobility skills to catch up. One of the other groups that Livingstone and Paleg mentioned however was that children who have multiple severe disabilities and who may never become independent community drivers can still benefit from independent, excuse me, still benefit from power mobilities, and our entire Power Mobility Project is based on this foundation, this idea that children can benefit from power mobility because we see power mobility as more than a way to get from point A to point B. When we think about children with multiple severe disabilities, sometimes we might think about children who are, maybe they have a lot of motor involvement, like these two children on the pictures here.

Maybe they have cerebral palsy and maybe they have limited use of their hands. Maybe they have limited communication and maybe they have unknown cognition. Maybe they're not able to move or speak reliably enough so that they can demonstrate their cognition, but power mobility can still be beneficial for these children. Let's go ahead and take a look at this first video here. So this first video is my friend Kennedy and Kennedy in this video that I'm having trouble getting to play here is a six-year-old. Kathleen, this isn't, okay.

So Kathleen says it's playing on your end. So I'll have to kinda guess when it's done, but this is a six-year-old who got cerebral palsy and who is a child who has limited verbal skills and she's really never been able to move on her own. She can use a gait trainer a little bit, but she's very, very limited. Kathleen, I cannot tell if the video is done or not, so I'm gonna go back to the PowerPoint and talk using these two pictures rather than the two videos. Hopefully the videos later in the presentation will work. My apologies for this technical issue, but you can see young Kennedy here on the one side of the screen here, on the left-hand side of the screen. She's six years old and she is a little girl who has cerebral palsy, limited communication. She does have some words, a lot of repeated speech. She's very happy and smiling as you can tell and she is also a

child who has limited hand use. We don't really know about her intellectual functioning, but she has been able to gain benefits of power mobility use by learning how to explore her environment, being given the opportunity to explore her environment, being given the opportunity to go ahead and interact with her younger brother using mobility and play patterns. The other young man, the other child on here's a young man. He is 14. He too has cerebral palsy, also has a diagnosis of autism and he does not have any verbal communication, although he is beginning to use some augmentative communication, a very beginner level, but he can again have some of the same benefits: learning cause and effect, learning the fact that he can make decisions, using his judgment as he's moving through the environment. These are all benefits of power mobility training in children with multiple severe disabilities. Hopefully our next videos will work and you can see the children.

Apologize for that. I talked a little bit in the objectives about different power mobility learner groups. Now Roslyn Livingstone and Debbie Field in their 2018 publication described three different learner groups. They described exploratory power mobility learners, operational power mobility learners and functional power mobility learners. Let's take a look at each of those. So in the exploratory power mobility learner, these are children who are very very young or who have additional learning needs and who are really just beginning to learn that concept of: I press a switch, I move a joystick and something happens, that idea of cause and effect, not only that they can cause an effect on their environment, but that they are the ones that are actually moving the device.

Our next group is kind of our middle group and that's children who are operational learners. They're learning how to operate a power mobility device. As you can see here in this picture, this little girl is beginning to learn how to operate a power mobility device in a slightly more complex environment. And finally, we have our functional power mobility learners. These are children who typically can purchase an individually

prescribed power mobility device, power wheelchair, and who are using the power mobility device as part of their functional routines and integrating it into their daily function. Let's go ahead and look at exploratory learners a little bit more here. So according to the work by Field and Livingstone, all young children begin power mobility use as exploratory learners, but the learner group in which a child is categorized is determined by the speed at which a child progresses. So a child who quickly grasps some of the cause and effect concepts will quickly move into that next learner group. Some other children will stay in this learner and stage for a long time. Children who stay in this learning stage for a long time often have cognitive limitations or sensory impairments and they may actually remain in this level for protracted periods of time and really continue to benefit from their power mobility use, but maybe don't get to the point of being able to maneuver and operate the power mobility device in different directions and things. In this learner group the children need very very frequent assistant and extremely close adult supervision 100% of the time.

When I'm working with children in this age group, we can't expect them to have judgment about what they're doing with the device, where they're going with the device and so we have to be right by them 100% of the time and be prepared to stop them by taking their hand off of the switch or off of the joystick if needed in order to keep them safe and to keep others within the environment safe.

Training methods for children who are exploratory learners relate to encouraging self-initiated mobility through engagement in individually motivating activities. So typically what I do is I find something that the child really likes and I encourage the child to use movement to explore. This kinda mimics the development of independent mobility skills in typically developing children. When you and I were babies and we were beginning to crawl, no one had to teach us how to crawl. We wanted to go get that toy. We wanted to go get the cat. Children today seem to wanna go get the remote for the TV or the iPhone. They are motivated to try to do something difficult because

remember when you're learning how to crawl, that's a difficult skill. So the children who are typically developing are motivated by things in their environment and we can mimic that for our children who are just starting out in power mobility. We can find what they want to do, something that they're interested in and allow them to experience using movement to go interact with that and play or do other things. For the exploratory learner, because they are so concentrated and focused on learning power mobility skills, we try to put them primarily to controlled settings and familiar environments. These are typically children that you don't want a whole lot of people around and a whole lot of people giving a whole lotta direction, but of course sometimes children like that type of stimulation.

So it really is dependent on the learner. However, for the most part, the controlled setting and familiar environment tends to help these children the most. When we're looking at power mobility training for these exploratory learners, alternative power mobility devices are things that we might use, something like, we used to have something called the Turtle Trainer and I know a couple of Turtle Trainers still exist out there. We have some power mobility devices that you'll see here in this presentation that are essentially motorized platforms, very similar to the Turtle Trainer, that temporarily convert a manual wheelchair or adaptive stroller into a power mobility device.

Shared or loaner equipment. When I was working at a school district, we had one pediatric power wheelchair and we tried to make it work for everybody by just, I'm chair rigging, putting in pillows, trying to position the children as best we can, or I sometimes would get loaner equipment. I would try to work with my local vendors and get a specific device. It wouldn't be of course customized, not like an individually-prescribed device, but is still an opportunity. And then for our younger children, we could look to the modified battery-operated ride-on toys. Typically these are operated with a single switch and this is a nice way to start for children, younger

children in particular who are exploratory learners. Here's some pictures of our power mobility devices from our program. So you can see here on this side here, we have on the left side we have a child who is in one of our play-and-mobility devices. We have several different versions of this and we have him in a car seat essentially on a mobile platform. You can see the wheel hub and this is a mid-wheel drive device. You can also see his legs are extended a tiny bit outside of the footprint of the play-and-mobility device. This was an indicator for us that it was probably time for him to move into another device because we didn't want his feet to impact something before the device impacted.

On the other side we have the power wheelchair trainer or trainer as we call it and here you can see that this child's adaptive stroller is on a motorized platform and it's tied down just like you would have on a bus or a van or something and they're able to use switches and joysticks to activate it. When we take a closer look at these, here's our power wheelchair trainer platform. We've got batteries and motors in the platform and the tie downs just like you would on a bus or a van, and then we have this bumper and that bumper comes off. When that bumper's off, you can extend a loading ramp that allows you to put the child in their manual wheelchair up onto the platform, then you can put the ramp back in, make sure everything's tied down, put the bumper back on and you're good to go.

To me this is kind of like a U-Haul trailer for those of you who are familiar with the U-Haul trailer, how a ramp comes out from underneath. The interfacing controls allow us to put any joystick, any switch that I can get an engineering student to adapt into the device, has to be one of the plug-in devices and I can use all four inputs or I can just use one which is a really nice way to work on training, particularly for children in this exploratory learner group. Here's a different version of our play-and-mobility device. Again, it's the car seat on top of a platform, a mid-wheel drive and a bumper. The bumper is to try to help protect walls as much as possible, and also to cushion

impact. We had one little girl that we worked with that we devised a specialized bumper that absorbed shock so that if she ran in something she wouldn't be injured 'cause she had osteogenesis imperfecta and fractured easily and we really want to make sure that she was safe. We wanted her to learn from impact, but we didn't want that impact to be so great that it could hurt her. Of course we set her speed really low so that it would also facilitate safety when she was driving. When we look at exploratory learners, our assessment tools, our outcome measures are goal dependent.

So if our goals relate to development, we're gonna use one set of tools or outcome measures. If our goals relate to exploration, we might use another set, and if our goals relate to power mobility skills, we might use yet another. Within development, many different types of tools have been used, outcome measures: the Barthel, the . Some of the other early intervention-focused checklists of development have been used. Related to exploration, sometimes I use the Canadian Occupational Performance Measure and have the parent identify occupational performance issues related to exploration.

Those become our goals and we can assess those with the Canadian Occupational Performance Measure, and then for power mobility skills, that we have several different options for outcome measures. So some of these outcome measures for power mobility skills are specific to children and there's several that are, whoops, I'm gonna go back there for a second, there are several that I really enjoy. The Assessment of Learning Power Mobility is, and we're gonna look at that one a little bit more. I also really like the Wheelchair Skills checklist. We're gonna again look at that one. You can use things like the Powered Mobility Program developed by et al, and then we've also developed a Power Mobility Training Tool that is showing some promise as an outcome measure. One of the things that is important when we're looking at exploratory learners is to understand that exploratory learners may never become independent

community-based power wheelchair users, but this is okay. They can gain cognitive skills, social skills, problem-solving skills and improve their mastery motivation all through power mobility use. Mastery motivation is that internal drive that we have to conquer challenging task and persist when something is challenging and typically developing children begin to develop this mastery motivation when they are starting to move independently and learning to crawl. They fight through to get to that toy that they want, that cat tail that they want to pull, that TV remote. So here we're gonna start looking at some exploratory learners.

Kathleen, if we have trouble with the videos as we come up, what I'll ask you to do is let me to know when the video is over. So here's our description, a little Gabby here. She was 17 months old when she started with us. She had spastic quadriplegic cerebral palsy. For those of you familiar with the CP classification scales, she was at a gross motor function classification level V, so at the lowest level of gross motor function, and at a Mini-MACS, the Mini-Manual Ability Classification System for children under age four, level V, so again at that lowest level. She had a cerebral visual impairment, seizures, and her family's desired outcomes related to her developing cause and effect skills and to learn how to use a switch. The test and measures that we used were the PEDI-CAT.

I really like the PEDI or the PEDI-CAT, but especially the PEDI-CAT for younger children. I think it really shows the influence of functional gains within the developmental trajectory. We also used the Dimensions of Mastery Questionnaire to look at mastery motivation for her and we tracked the number of switch activations that she had. So when we we're looking at her intervention, we provided power mobility training for 60 minutes per week for 12 weeks. We used our play-and-mobility device and we started with one switch. Kathleen, can we go ahead and try this video here? So I'm not seeing the video and I, oh, hey, it just came on, hooray. So here you see Gabby in her car seat within the play-and-mobility device and my student is just trying to encourage her to

activate the switch and learn about the switch. We've interviewed Gabby's family and her dad who's her primary caregiver at this point said that she appeared to like toys that light up. She appeared to like shiny toys like the mylar pom-pom that you see and she also liked ribbons on her face. So my student kinda crafted a toy that had ribbons hanging off of it. She appears to be going a lot faster than she is. She really isn't. We're going to return to our PowerPoint here, but you can see how she was just really learning, exploring the power mobility device, and to me that kind of typifies an exploratory learner. They're exploring the power mobility device. They're exploring their environment.

They're exploring the access method, in this case, the switch. As she progressed, she became more adept at using a switch and we added in a second switch. In this video, Kathleen, why don't we go ahead and put that up, but in this video what we'll see is that she is playing interacting with a large therapy ball. Now her dad told us that she was very drawn to the color red so that's why we used a red therapy ball and you can see how she's pushing the switch and interacting with the ball. I'm going to pause it right there 'cause hopefully you can see up in the upper left-hand, excuse me, right-hand corner, a pant leg and then a wire.

So we have what we call shared control. It's an attendant remote that allows us to maneuver the device. So as long as Gabby is activating a switch, we can maneuver. So we've given her a forward here and we've given her one turn. So if we need to help her by maneuvering to the opposite direction from the turn that she has or maneuvering backward, we can help. We can also fully take over in case of an emergency and stop, let's now return to our PowerPoint, Kathleen, but this shared control allows us to help the children to keep moving. If you think about a traditional power wheelchair where you might have to interrupt a child's driving, so you have to take their hand off of a switch to stop them or take their control completely away from them in order to use the attendant remote and sometimes even stop and switch modes in order to get that

attendant remote, it can be very interruptive to the child who's trying to learn cause and effect. So this can be very helpful, we found. So here she is a little later on. In this video, we see that she's beginning to play and interact. So as I told you, she really liked the feeling of ribbons on her face. So my student developed this, we call it the ribbon carwash, and she used to just love going to get it and she would drive into it and stop and move her head back and forth, back and forth, side to side to try to get the ribbons.

Now you can see here that she is still learning, so she's going into the wall, but that's okay, that's how we learn, and then we can also help her to understand that she can get off of the wall and turn. We need to back her up a little bit. We talked to her about that, tell her what we're doing, and she can make choices and decisions about what she wants to go and where she wants to go and what she wants to do. One of the things, let's go back to our PowerPoint here, one of the things to kind of keep in mind is that we could provide totally error-free learning and in the initial stages I do use the shared control to provide error-free learning or if the child is getting really tired or frustrated, I can use the shared control so that they're not running into things.

They're not perceiving that they're making mistakes, but eventually for the child to learn I have to add that back in. Again, through the shared control, I can even decrease the rate of impact so the child has a gentle bump rather than a huge impact. I love this picture because I think it really shows how Gabby was activating a switch. Now I don't think she knew that she was going right or left or forward. I think she understood that she was moving in different directions, but if you think about your typically developing infant who's just starting to move, I don't think they think, oh, I am crawling to the right now, or, I'm crawling forward five feet, and then turning to the left. So I think that it's okay that she doesn't recognize right, left, forward. What's important is she recognizes that when she pushes a different switch, she goes in a different direction, and it's really fun to see the children develop these types of skills. So she had some really nice

outcomes here. So on the PEDI-CAT, there are four different domains. You can see that in the Daily Activities Scaled Score, she remained the same. Mobility Scaled Score, she went up a tiny bit. In Responsibility Scaled Score, she remained the same, but in that Social Cognition Scaled Score, she improved and she also overcame the standard of error in that measure. So this is considered to be valid or true change because she was able to overcome that standard of error and show true change using the PEDI-CAT. Some of the other things that we looked at were the DMQ and switch activation, so the Dimensions of Mastery Questionnaire that looked at her mastery motivation, that perseverance, that persistence to do a difficult task. She had higher scores in social persistence with adults, so getting adults to interact with her, and expressive mastery motivation, her ability to express her motivation.

Also you can see that she had a really large increase in switch activations, but what this graph doesn't show us is that she also had a huge increase in the duration of her switch activation. So at first she might've just been accidentally hitting the switch and learning that she was moving when she hit the switch, but by the end she was purposely hitting the switch, activating the switch, maintaining pressure on the switch so that she could drive further or spin longer.

So I did wanna talk about expectations for exploratory learners when your goal relates to exploration and learning because I think it's important that we have realistic expectations for children. So you just saw Gabby when she was 17 months old and she was about 20 or 21 months old when she stopped that initial session of power mobility training. Well she came back and trained with us again when she was three and in this video what we'll see is some changes in her abilities. So when we look at her now, not only is she bigger, she is beginning to use our power wheelchair trainer, which is a rear-wheel drive so it's a little different to maneuver, but she's also interacting more with people. I'm gonna pause the video right there so you can see. So what happened was she was interacting with her dad and two of her sisters and she

was really attached to a bigger sister and she wanted to go give big sister a hug. She loved to go get hugs and kisses from big sister. So we set up the environment so that she had to activate the switch and turn towards her sibling and as soon as she turned toward the sibling, I took her hand off of the device for safety and allowed her to get that kiss. So you see I have the sibling coming in and she gets the hugs and kisses, that praise and interaction that she so desires from her sibling. Kinda take a look at that one again. She's coming forward. She's trying to get to her sibling, but she can't quite figure out which button she needs to push. She knows she has to. Push a different button, she's trying to figure it out, and now she's turning over this way, and now she gets her reward, and it's important that she gets that reward right away. Sometimes what we wanna do is we wanna keep backing away from the child, keep the child moving, and really it's important to establish that reward. Let's go back to the PowerPoint.

So when we're establishing that reward for the child, giving the child that immediate reward, we're helping them to understand that they can move, that they can act on their environment, that they can be successful. When children are unable to get that immediate reward, they can become frustrated and discouraged and might feel like, oh gosh, I'm doing all of this hard work and I'm not getting any reward. That's why it's really important to start small and build up to larger rewards that take longer and are harder to get. Now I want you to kinda look at this next video and note that we are looking at some different things here. So we just saw young Gabby very intentionally try to get to her sister that she wants to go to, but we also see her here almost taking out one of our engineering faculty members when she makes a sudden, unexpected turn. So what we are looking at here is the expectation is that Gabby is learning, that she's exploring. We don't have the expectation that she's recognizing, oh, Doctor Rhodes is on my side there and I shouldn't turn quickly. She doesn't have that ability to make such high-level judgment calls yet. Going back to the PowerPoint, so we wanna make sure our expectations are in line with what the child's abilities are and again in

this early phase we're oftentimes looking for exploring the device, exploring the environment, exploring the access method, either the switch or the joystick. I often start with a switch just because it's easier. Let's fast-forward here a little bit and before we get to this video, I wanna talk a little bit about what we're gonna see 'cause it's a very fast video. So we're gonna fast-forward a little bit. Gabby completed another round of power mobility training with us and we really noticed at the end of that third round of power mobility training, and keep in mind she was about five and a half, five and three-quarters when she finished that third round of power mobility training, but we really noticed that her understanding of a switch had dramatically improved. She'd started using a switch to activate toys outside of the power mobility device and that's something we see quite often.

We see that the children understand, oh I pressed this switch and I moved this power mobility device, before they understand that they can activate a switch and get a toy to turn on or turn on a music player or a CD player. I guess it would probably be an iPad or something now, but we often see that the children develop cause and effect skills in power mobility use before taking it outside, but at the end of that third round of training with us we noticed that she was really understanding switch use and cause and effect outside of the power mobility device. Although she was nonverbal, we really felt that she was more socially engaged and interactive.

She was even playing some little games with the power mobility device in our trainer. She would pretend to be going and getting a hug or a kiss from her preferred sibling, different sibling at that point. In the last minute she would turn the opposite direction and head away and run in the power mobility device, move fast in the power mobility device showing us that she was playful and interactive and laughing and tee-hee-ing. So she went for an augmentative communication device evaluation. Keep in mind, remember, she has a cortical or cerebral visual impairment, nonverbal, and we really don't know what her cognition is. Here's a video, we can go ahead and bring that up,

Kathleen, here's a video of her trialing this augmentative communication device. It's very fast. We're gonna play it twice. So I've taken some pictures of things, let's play that one again 'cause it didn't come up on my screen so I'm gonna play it again here. So they've taken some pictures of what they played with throughout the session, and then they have asked her, "What do you want to play with?" She chooses the iPad and they ask her, "You want the iPad?" and she goes to yes. One more time, watch her choose the iPad, and then they ask her, "Do you want the iPad?" She says yes. This is just an incredible first trial of an eye gaze communication device. She qualified for a trial of an eye gaze system based on that trial.

She now has her own eye gaze communication device and it's so much fun. I was in the home last spring and she was, we're working on some stuff with her manual chair and she looked over, about three feet away, turn on the device and started playing a game with her eye gaze communication device. It was one where if you maintain your gaze on the animal, the animal will make the appropriate sounds. So she was activating the cow and the horse and the dog and she was really I think trying to communicate with us that you adults are talking too much about my chair and I'm not having any fun so I'm just going to leave you alone. I'm gonna play with my communication device.

Let's head back to the PowerPoint, Kathleen. So again having realistic expectations about driving with her cerebral visual impairment, she may not be safe to drive unattended in community settings, but we noticed that she was developing these other skills. Although I can't make a specific causal reference and say that the power mobility resulted in her being able to use augmentative communication, certainly there is a suggestion that it was helpful in her journey to be able to learn to communicate. Another way we can use power mobility with exploratory learners is as an intervention and in the next couple of cases that we'll look at, we look at cases where we use power mobility to provide an intervention, an opportunity for problem-solving, gaining

stimulation, vestibular, visual, making decisions, choices, but for children that we knew that power mobility wasn't the ultimate goal. So when we are using power mobility in this way, we still refer to the children as exploratory learners because what we're doing is having the child gain benefits from exploring the use of power mobility even though the goals of power mobility use don't relate to long-term use of a power wheelchair. So let's look at our next case here. This is a little guy who's using power mobility as an intervention.

So this little guy was just about four when he came to us. He had a diagnosis of triplegic CP and autistic spectrum disorder. He had really good posture control and excellent balance in sitting. I was really surprised that he was not trying to crawl, trying to move around in any way, had no interest in a walker, no interest in moving. Mom used to say that she would come into the house, put him down in the middle of the floor. She would go about the house doing her task, put away the groceries, whatever, and she would come back and the child would still be in the same spot. Mom's desired outcomes for power mobility use included developing cause and effect skills and interacting with the environment, but in my experience, I was surprised that somebody with such good postural control and excellent sitting balance really was not able to perform any locomotor task.

So I hypothesized that it might not be motor related that he was having difficulties with locomotor tasks. It could relate to either his lack of understanding of locomotor skills or his lack of experience with locomotor skills. So we looked at evaluating his power mobility use using the Assessment of Learning Powered Mobility Use or the ALP. The ALP is an eight-level instrument, there's eight phases, that kind of outline the process of power mobility use. They look at different facets of power mobility use. Within each level there's attention and tool use, so use of a switch or a joystick. There is different things about emotion. There's several things within each ALP phase. We also use the Canadian Occupational Performance Measure as I described previously and we did a

maternal interviewer where we talked with his mom, pre and post, and have looked at changes in her perception of his abilities. We provided power mobility training for 45 to 60 minutes per week for 16 weeks. We trialed the power wheelchair trainer, but I felt that he would do better in the play-and-mobility device. He was small enough to be in our play-and-mobility device and I thought that the play-and-mobility device would bring him lower to the ground, give him more sensation of movement, and also allow him to be more at a peer-level height. Let's take a look at this video. Now we started with one switch and like I said I often start with one switch 'cause I want a child to be successful. I even placed his hand on the switch and lay it there and letting him play with it, the switch, and learn how much pressure he has to put on, learning to sustain the switch, learning that he can stop.

You can see here, he's got a slightly interesting way of positioning himself. He wants to hook his leg over his own adaptive stroller, but this is his own adapter stroller. Mom says that's the way he likes to sit so I'm gonna let him do that, but you can see that he's just learning and exploring and is really still at this initial session, not yet able to fully comprehend that idea of cause and effect. If we go back to the PowerPoint, one of the things is that we need to let the child have time. As adults sometimes we want to just jump right in there and have the child doing all these things, but it's important that we try to restrain ourselves and let the child explore.

So we emphasize development of cause and effect skills and tool use. Now occupational therapist might be more familiar with tool use, but tool use is that idea of using an object for a purpose. As PTs we might recognize that tool use is necessary for somebody to be able to use a walker. Until you have the concept of using a tool, you're not gonna understand that the walker is going to help you to be able to stand up, and the same is true with a power mobility device. You need to have that concept of tool use to know that the switch or the joystick is the tool that you're using to move. We let him do purposeful play and movement and explore his environment. So we started

with one switch like I said, but in this video, as that one's coming up, we allowed him to have a second switch and we did that very intentionally because he was showing more intentional use of the forward switch. Now I can make the one switch go just left or just right so the child can spin. I often start in spinning, but you can see here he's going forward, he's sustaining his activation. Look at the intention that he's playing to his environment, and then his ABA therapist helps him to transition to that other switch and learn that he can go in another direction. Look, he stopped and goes back to going forward. I just love all the learning that was going on here.

Coming back to the PowerPoint, his learning was what was happening and as we come back to the PowerPoint here we'll see in our next video that what we did was we decided to move him to a joystick. Now moving him to a joystick didn't have anything to do with the fact that we thought he was going to be a power mobility user. We wanted him to have four degrees of freedom and we wanted him to begin to understand that idea that he could cause an effect on his environment.

So in this next video, as Kathleen brings that up, we'll see that he is learning that he can go get an object. So he's not exactly happy because he's used to fussing and having something bought to him. Here we have his Z-Vibe, one of the few toys that he's really engaged with, and he really wants it, but it's just out of his reach. We're asking him to use his joystick to go get it. We know that he's able to do this otherwise we won't be asking and we've asked him to come a certain distance. He hears his mom and he decides, no, he wants mom instead. So he comes and interacts with mom and mom really seemed to appreciate that he was preferentially interacting with her and they we're playing games and doing all sorts of really fun things. Coming back to the PowerPoint, again our outcomes did not relate to power mobility use. They related to learning cause and effect and being able to explore, but I also wanted him to understand movement. I wanted him to grasp that idea of mobility of movement. So in our outcomes, he progressed from a novice phase 1, that lowest level in the ALP, to a

sophisticated beginner who is conscious of cause and effect, and is a huge leap, huge cognitively, really showing he was understanding cause and effect. On the COPM, we can see here his performance and satisfaction scores from his mom on his occupational performance skills. One of the nice things about the COPM is there is a known clinical significance level and we know that if a child has an increase of two or more points in performance or satisfaction, that's considered clinically significant. So you'll see here that not only did he increase two points, but more than two points on performance and satisfaction in every single one of his identified occupational performance issues. The caregiver interview, remember we did the maternal interview, showed that mother perceived improvements with her son's understanding of mobility and that the child was exploring the home or using a scooting pattern on his behind and appeared to be interested in moving.

He also started to use a walker and was indicating that he understood the use of this walker and it was really exciting to see this. I do remember the first time that mom came in. Now remember at the beginning of our power mobility training, and we only did 16 weeks, mom had described how she came into the house, put him in a specific location, went about putting away the groceries or whatever and came back and the child was always there. Well, about midway through the training, she came into the house, put the child down, unloaded the groceries, started putting the groceries away. She said she was probably gone 15 minutes or so.

She could hear him kinda babbling but she came into the living room where she put him down, where she always put him down, and he wasn't there. Scared her to death. He had started scooting and was exploring his environment and she found him in another room. She had to quickly do all sorts of childproofing for the house and everything, but he'd learned that he could move and that he could explore and he could interact with his environment. Again, with a case like this, we can't create a causal relationship. We can't say it was definitely the power mobility that influenced his

ability to learn how to move and understand, no pun intended, the power of mobility, but we can say that perhaps it had an impact. In just the months, just the months, six months after completing the power mobility intervention, he was independently ambulating without a walker in all environments and even started running. He particularly was known to run away when he didn't wanna do something and was running away from his mom and his ABA therapist quite frequently, but just showing us that short-term power mobility use as an intervention may help children who we think will be able to or we know will be able to independently ambulate. So when I did my initial examination with this child, there was no motor reason why he shouldn't be moving and I think showing him a little bit of what movement can do and what movement is like may have spurred his interest in movement and mobility.

So here's another little guy who we used power mobility as an intervention with. So in this case he was a three-year-old, 21-month-old, three-year 21-month-old young man. He was 15 months post acquired brain injury. He was previously typically developing. At the time we started he was able to sit and do some very very limited crawling. He was unable to use a walker and wasn't interested in using a walker, but as a child who at 15 months was typically developing, he was independently ambulating, saying some words and had all other skills on age level.

The desired outcomes in this situation included increasing interactions with other people and exploring his environment. So he was 15 months post the acquired brain injury and again had been typically developing up until the time of his injury at two something, two years something months. We used again the Assessment of Learning Powered Mobility Use, the ALP. We used the PEDI-CAT. We used the Wheelchair Skills Checklist. Now the Wheelchair Skills Checklist is one of my favorite. It was developed by Charlene Butler way back in the '80s and it's essentially just seven skills and it's seven skills that a child in Doctor Butler's mind needed to be able to do to be able to show that they could use a power wheelchair effectively. So it's things like moving

forward, stopping, driving up to furniture, turning right, turning left, making a 100-degree, excuse me, 360-degree turns, backing up. So it's stuff like that. There are some items on the Wheelchair Skills Checklist that are done on command. So the child has to have not only the skill from the power mobility device standpoint and skills standpoint, but also the communication ability to be able to process the verbal request and respond to the verbal request. We again used the Canadian Occupational Performance Measure and a caregiver interview.

So we again provided power mobility training for 45 to 60 minutes a week for 12 weeks. We used our power wheelchair trainer. He's a little too big for our play-and-mobility device. Again I started with one switch, but by the end of that first session he was using three switches and quickly went to a joystick. Let's take a look at this video. This again is a video from his first session. So remember I started the session with a single switch and he was so successful with that. I like to start with a single switch and move up from there 'cause the children can be successful and I love how he is interacting with his environment, watching his environment, smiling, and then he's choosing to go to the other side.

So he has forward, right, and left, and he is showing us how he knows the differences between. I just love how he is interacting here with the device and enjoying the movement. The smile on his face is just so fabulous. If we had auditory on, we'd hear that dad is saying, "You really shouldn't be running into those walls," and I'm saying, Oh, they're okay. They're not my walls. They belong to my dean, but I love how, which is why we have the bumper, so that it doesn't destroy the wall, but I love his expressions. As we return to the PowerPoint here, this is a child who'd had a brain injury, and when we return to the PowerPoint we'll see as he progressed that he was responding to the power mobility training in different ways and because of his brain injury, he is having a lot of emotional swings. Remember, he's only 15 months post brain injury. So it's really a time of rapid recovery for him, but one of the things that

both of his adult caregivers mentioned at that first session was they hadn't seen him smile in a long time. They hadn't heard him laugh in a long time and they we're so excited that he was smiling and laughing while trialing our power mobility device. So a few weeks later, we decided to introduce the joystick. As we go to that video, again I wasn't using a joystick because I thought eventually he was going to be a power wheelchair learner or user. I wanted him to learn how to use a joystick because you have so many degrees of freedom in a joystick and there's so much to learn from a joystick. So here you can see he's a little bit more serious.

He's attending. He is moving through the environment, kinda stopping and looking, kinda serious about his power mobility use, and he really likes going towards the wall and trailing the wall so he kinda smiles a little bit as he gets to the wall area there. Again you can see that we have an adult on our attendant control back there and so we again can adapt and adopt his inputs from his joystick to keep him safe. We can maneuver him, but at this point we're choosing to only use those features during times of safety: when he might hurt himself, or he might hurt someone else, because we want him to experience error.

As we go back to the PowerPoint, we want him to experience error so that he can learn from his environment, learn about running into things, learn about spatial awareness, learn how he can maneuver. And as he progressed, we encouraged a lot of problem solving a lot and making choices and decisions and we provided a lot of opportunities to hone attention and spatial awareness skills. These are all things that are things that should be encouraged or are typically encouraged rather in children who are recovering from a traumatic brain injury or acquired brain injury. So his outcomes on that Assessment of Learning Powered Mobility Use, he started at a higher level. He started at an advanced beginner stage, but he went almost to the top, almost up to that full tops phase, he was at a phase 7. There are only eight. He had significant change in daily activities on the PEDI-CAT. Again he overcame the margin of error and he was

able to perform all seven skills on the Wheelchair Skills Checklist. Here on the COPM, again you'll recall that an increase of two or more points on performance or satisfaction is considered to be clinically significant and on a lot of these, all of these you can see that he improved by two or more points. Again, I have the parents identify this, and this has just been a really helpful tool because the parents have identified the occupational performance problems. In the caregiver interview at the end of the training, the caregiver described the child as happy.

He was not having as many outbursts or tantrums. She felt that he was less frustrated. He was saying more words and putting words together and he was showing improvements in mobility skills when not using the trainer. He too started to use a walker and he started propelling and maneuvering his manual wheelchair which gave him more independence, more mobility, but in the months that followed, he actually started independently ambulating in all environments. I guess it was about nine months afterwards that he was without a walker and even running. When mom sent me the video of him running, it was just such a wonderful thing.

And again we didn't use power mobility as a way to get him to use a power mobility device better down the road. We provided him with opportunities for problem solving: decisions, choices, using attention, all of these other things that may have helped in his recovery from an acquired brain injury. Just a quick note about assessment tools for exploratory learners. When Field and Livingstone described the three learner groups, it was in a systematic review of power mobility outcome measures for children and they looked at different outcome measures within the literature, published literature, and try to match them with children in different learner groups. One of the tools that they found that may be appropriate for exploratory learners is the Power Mobility Training Tool. The Power Mobility Training Tool was developed in our lab and it was developed to identify basic power mobility skills in children, can be used with children who use switches or other alternative access methods. At the time when we published it and

developed it, it was the only such tool that could be used with children with switches, but we developed it to guide the development of power mobility training programs to promote the emergence of basic power mobility skills. We didn't develop it as an outcome measure or to determine who qualifies for power mobility, but in the systematic review by Debbie Field and Ros Livingstone in 2018, they felt that it could be potentially an appropriate outcome measure for children who are exploratory learners. So we began to look at that a little bit more. Ros and Debbie, Debbie Field and Ros Livingstone, have used the Power Mobility Training Tools as one of the outcome measures in their study. It's a pretty straightforward little measure, 12 items. We have motor, non-motor, cognitive, one non-scored item and a couple items that are scored dichotomously. Items scored dichotomously have to do with is the child well-positioned, is the child appearing motivated to drive 'cause those are all things that can influence performance, but we provide the Power Mobility Training Tool free of charge.

All you have to do is email us and my email address will be provided at the end of the presentation. Moving on to operational power mobility learners, Field and Livingstone described operational power mobility learners as those who need an extended period of time learning the basic skills related to operating a power mobility device. So they already understand those cause and effect concepts. They're now working on operating, moving, and their expectations are gonna be influenced by the environment, more complex environment, more difficulties, perhaps with driving. So they need close supervision and intermittent assistance. Again the adults should be close enough to take that hand off of the joystick, off of the switch as needed for safety and we may have to provide some intermittent physical assist. Training methods, a lot of play activities that incorporate basic power mobility skills and lots of practice opportunities. We've done a number of studies looking at trying to get to the idea of dosing and all I can tell you is lots of practice as needed by majority of children, particularly children in the exploratory and operational learner groups. Control settings are kind of preferred,

but again occasionally have one child who really likes or is motivated by having a lot of people in an environment and cheering them on. As far as devices, again, you can use the alternative power mobility devices, the shared or loaner equipment, or the modified battery-operated ride-on toys. At this stage it would be best if the modified battery-operated ride-on toy had more than one switch so the child can work on maneuvering. So if they either had more than one switch or a joystick, when we modify our battery operated ride-on toy cars, we modify them for four switches so that we can have all directions, but we only introduce whatever directions we want and we can have that single direction remember be forward, could have it be right or left so the child spins, which is often where we start. I've never put a child in just backward, but there are cases where you might switch and have the child pull backward to go forward, but that is a little bit of a perceptually complex issue so it's not something I start out with.

Again assessment tools depend on goals and if we are looking towards a power mobility device, an individual prescription of power mobility device, we're gonna really focus in on those power mobility skills. Expectations relate to typically progressing skills, but children who are using alternative access methods who are unable to use a traditional joystick often fall into this learner group and require more practice to be able to learn how to use the device.

Children who use a head array often fall into this, children who use different switch access. We had a child who you've seen in a little bit who was driving using switches embedded into a bite-splint and he activated them with his tongue. Children with alternate access methods typically require a lot more in the way of practice. Children in this group may or may not progress to that independent community power wheelchair users or qualifying for their own power mobility device, but that's okay. Again they're learning, and exploring, and doing, making decisions, and choices, and benefiting. a lot of times non-child related factors can come into play as you'll see with some cases

that we're gonna look at here. So I'd like to introduce you to one of our learners who was using an alternative access method. He was using tongue access. So this young man started with us when he was seven. At the time of this case description he was nine and we'd worked on access issues for that period of time. Some of the reason that the access was kind of a little slow as we we're relying on student engineers to design and build things. So we we're working at the pace of students, but we tried several different access methods before we were able to hit on something that worked well. So when you look at his classification system levels using the classification systems for children with cerebral palsy, he's at the lowest level on the gross motor function classification system, lowest level on the MACS.

In fact he had no reliable voluntary movements of any extremities and complete lack of head control. Even with his head was supported, he lacked the ability to make fine movements with his head. He was at a communication function classification system level III, very verbal, highly intelligent, lots of speech, but he was very breathy and could not be understood well, particularly by unfamiliar receivers of his communication and therefore his CFCS level was a little lower, but his eating and drinking ability classification system level is at a level I, and that's why we really trialed, we trialed some other things, but once we figured out that those things weren't gonna work, we quickly went to the tongue because he was eating and drinking at an age-appropriate level.

Now he couldn't bring the food to his mouth, but once in his mouth, he was chewing like he did not have any dysarthria to his speech like children with spastic athetoid CP can sometime have. So really identifying where his strength was was how we solved his access problem. So we again used the Assessment of Learning Powered Mobility Use, the ALP with him, the Wheelchair Skills Checklist, and the Canadian Occupational Performance Measure. We developed a bite-splint device. So this was designed and built by undergraduate engineering students. We worked with an orthodontist to create

a mold that a orthodontic laboratory created a bite-splint-like device. It's a little hard to see here in this middle picture, but you can sometimes you can maybe make out a little bit here is we had two different pieces so they were overlaid. I never realized how small the palate of a nine-year-old boy was until I tried to fit in four switches 'cause I wanted him to be able to go forward, right, left, reverse, and have a Bluetooth chip in there so that we wouldn't have to have wires coming out of his mouth to a device, but again that palate was awfully small so we were only able to get in switches for right, left, and forward, and we had it wired coming to a box on his lap that then had a Bluetooth chip that could interact with our power wheelchair trainer. We provided power mobility training with him for once a week for 45 to 60 minutes for 12 weeks.

Again we used our trainer and the activities with him involved play and activities focused on operation of the device. He really liked playing games like cops and robbers. I was arrested numerous times and escorted into our pretend jail. We played superhero games. He liked wrestlers so we would printout pictures of the faces of different pro wrestlers and put them on bolsters and he would knock over the bolsters and that way win the wrestling match. He was so much fun to work with. Here is a session early in his training.

As we go to this video, he had the idea that once we figured out access that it was all gonna be easy and it would just be so easy for him to use the device. H was getting a little frustrated at first when it was difficult for him to use his tongue to access device. He could do it. It was just challenging. Gonna play this one again. Anyway, he found it a little challenging, like just give me a couple weeks, but within that couple weeks he was able to do things, like you saw he was caught up on the wall. He was able to stop his progression, get off the wall by switching to another switch, and then go back to using this forward switch. So really making a lot of gains just within the couple of week periods. As we go back to the of PowerPoint, again it's important to understand that expectation. I knew that he was likely to be successful, but not immediately the way

that he thought he would do. I knew from the literature that because he was using an alternative access device, an access device that is quite challenging, think about sustaining your tongue position at the roof of your mouth so that you can specifically activate a switch to go forward. It was challenging, yet within a couple of sessions he was progressing nicely. By the end of our time together, he was quote-unquote running the bases at his Miracle League baseball game. So here he is with his dad. Let's go to this video. His dad's on the trainer here. He's on the attendant control, just in case. You can see that the child is all excited and running bases for the first time. Usually somebody had to push him in his wheelchair, but on this day he was able to run the bases and he really enjoyed it.

I'm not sure that everyone in the audience knew or everyone present at the game knew that he was doing something like this for the first time, but those of us that did had a hard time keeping a dry eye. As we go back to the PowerPoint, it's important to remember the self-efficacy, the self-confidence that can be gained from learning a hard task like this and we really saw those types of things improve in him and his abilities to know that he could do something we're increasing and gaining.

So in his outcomes he too progressed quite nicely from an ALP phase 4, advanced beginner, to a phase 7, proficient. He was able to do all of the skills on the Wheelchair Skills Checklist, except for reverse, but he didn't have an option for reverse because his palette wasn't big enough to put in that fourth switch. So the driving skills that he achieved were things like being able to drive forward down hallways, do right and left turns, spin 360 degrees to each side, stop in response to environmental cues, which is I think in some ways more challenging for a child to learn than stopping on command. He of course was able to process our commands and stop on command. He was also a very very safety-conscious driver, which is a little unusual for me. Like if one of my students was too close to the device, he would tell the student. He would stop and tell the student, "I can't drive any further until you move to the side more "so that I can

make sure you're safe," so very conscientious driver. He was able to move through doorways and narrow spaces. He was able to maneuver the device and approach furniture without running into it. So he gained a lot of nice skills. On the COPM, again remember an increase in two or more points in either performance or satisfaction is considered clinically significant. Here you'll see that in performance, he increased more than two in every item. In satisfaction, he didn't always improve more than two or maybe had gotten to the top of the scale.

So looking in that first one, sustaining forward movement 20 to 25 feet, his mom had rated him, his performance says at a two at the beginning, but her satisfaction with that a nine. And at the end she rated it as an eight on performance and a 10 in satisfaction. Sometimes we even see that parents' satisfaction will go down. In this case I talked to the mom about her idea that she was satisfied with his performance at a nine level, at a very high level, a nine at the beginning of our training. She talked about the fact that, well, when we we're starting, she wanted to make sure that he knew that she was proud of what he was doing even though he didn't see the scores and that she was okay if he was not able to develop these skills.

She knew that she was asking him to do something hard and she was okay with that if he didn't achieve that, but it didn't give her much room to go up in satisfaction. Sometimes we'll see a child who has low performance scores and high satisfaction scores at the beginning of training and at the end of the training period will have exceeded the clinical significance for performance, but actually have dropped in satisfaction. Sometimes parents will tell me that that's because they didn't realize what their child was capable of until they had a chance to use a power mobility device. This is an issue where non-child related factors can influence functional power mobility use and readiness for an individually prescribed power wheelchair. This was a young family. They just had had another child so they had a baby at home and they just were not quite ready for a power wheelchair in their home. They'd recently bought a home. The

home was fine for the child's manual wheelchair. They could push the manual wheelchair around, but they didn't have a ramp to get into the house. They were carrying the child and the chair in separately. There was stairs going into the basement that couldn't be easily blocked off. The doorways needed to be right in. The bathrooms weren't accessible. So there were a whole bunch of other things, and also they didn't have a way to transport a power wheelchair, which is an issue with some insurance providers in our area. So he was able to qualify quote-unquote for prescription of individually prescribed power wheelchair when he went to our local seating and mobility clinic for a power wheelchair examination. However the family decided to delay that because of these other factors.

Some of my students were really disappointed about that. Like, "well, gosh, "we worked so hard to do this, everything," but I think that in trying to explain to them that it was really up to this family. We provided him with the opportunity, but each family has to make decisions on their own and we needed to respect the family's decisions and respect the family's acknowledgment that there were a lot of factors that needed to be changed within their home for them to feel like their child could safely use a power mobility device and home modifications and things like that are not easy nor are they cheap and they're not funded by insurance.

So there's a lot of non-child factors that can come into play when looking at power mobility. Our final group are the functional power mobility learners. So functional power mobility learners progress quickly through exploratory and operational stages. I was on a Zoom call, a Zoom conference call yesterday with Ros Livingstone of the Livingstone and Field who developed the idea of the three different types of power mobility learner groups. She talked about the idea that although there aren't any hard and fast rules about how quickly somebody has to progress through the exploratory and operational stages to become a functional learner, she really felt that if a child was spending more than three to six months at an operational or exploratory phase and being given

opportunities regular, frequent practice opportunity, that they probably we're gonna have a slower trajectory or maybe be a child who remains in those early stages, but of course we all know many children who we've just put into a power mobility device and they within a session have gone from exploring the operation of the device to maneuvering the device to beginning to use it and play another function. So functional power mobility learners are focused on integrating use of power mobility into their daily life activities. The learner needs age-appropriate supervision. Oftentimes I have to explain this to families, particularly families who only have one child and their child needs a power wheelchair.

They're not used to having a child who can explore and get around and do things that perhaps might be a little unsafe. So supervision is often provided from a short distance away, but it really depends on the child's confidence, the abilities, and age, as well as the environment. When I'm working with a child and we're in a pretty quiet environment like in our laboratory setting, I can back away from the child. I can still be available, but I can back away from the child a little bit, but if I'm at the mall and it's very busy and we're working on driving in the community, I need to be right there with the child where I can take the child's hand off the joystick or off of the switch.

Training methods for these groups relate to refining power mobility skills, progressively using the power mobility device in more complex situations and environments and integrating the power mobility device into daily life experiences. Progressively as well we're looking into more open or unpredictable environments and helping the child learn how to respond in changing situations. If you've ever been in a elementary school cafeteria during lunch time, to me that's the definition of an open unpredictable environment and it's very loud and noisy and there's so much going on. That's not where I'm gonna start an exploratory learner, but it may be exactly where I need to work with a functional learner so that that learner can learn how to use their power mobility device in that busy unpredictable loud noisy environment with many children

running around. Devices for these learners relate to shared or loaner equipment, but as we said that this is also the group that depending on where you are and what the qualifications are from your insurance and providers in your area, they make quote-unquote qualify for an individually prescribed power wheelchair. Now I know that some states I understand like Vermont and Colorado really all you need is a mobility limitation to be able to have a power wheelchair, but here in Michigan where I live, a child has to show a lot of skill before they can have an individually prescribed power wheelchair and they also need to show good judgment which is very nebulous to try to assess in any child.

So it can be kind of challenge for a child to quote-unquote qualify for an individually prescribed device in our area. Assessment tools again are goal dependent, but here the goal often relates to qualifying for a power wheelchair or using the power wheelchair within a busier environment. So confidence in power mobility use and power wheelchair use may also be a goal here. Work by Paula Rushton out of the University of Montreal really focuses on how confidence, our lack of confidence in power wheelchair skill can influence an adult or a child's use of power wheelchair skills functionally.

Doctor Rushton developed the WheelCon, having to do with confidence in wheelchair skills for adult users, and has also developed it for pediatric users. That has not been published yet, but I'm waiting 'cause it's supposed to be available very soon. I'm looking forward to being able to use that tool in my practice, but also goals may relate on improving functional use of power mobility in daily life, and research suggests that this might be an ongoing process. In a qualitative study that we did with families and therapist, we learned that children who have a power mobility device, power wheelchair, are constantly learning about using that device functionally in different settings. One mom talked about the fact that every fall when the child is on a different school bus, the child has to relearn how to drive his chair onto the specific lift of the

specific bus, and then once they're lifted up in the bus, they have to learn how to maneuver themselves within the small confines of the adaptive school bus to be able to be independent in getting on and off the school bus and that was something that they had to do each year because the school bus changed each year. So it really is interesting how children will maybe need check-ins or additional training. One time period that I noticed that's really helpful for additional training, like a little tuneup, is when a child's changing like from elementary school to middle school or changing from being in a classroom where they stay all the time to maybe changing classrooms for different subjects.

Another big one even for children who've used power mobility devices for long periods of time that children who started to use a power wheelchair when they were like two, and then when they get into high school, they we're facing some other challenges and needed just a little bit more training. Coincidentally research shows that adults using power wheelchairs can also benefit from periodic check-ins and additional training. So functional learners may start when they're very young as an exploratory learner, but they relatively quickly will begin to progress towards qualifying for a power wheelchair, and this is really important for us to remember.

So I wanted to take a quick look at a functional learner who progressed very quickly from a young exploratory learner to qualifying for a power wheelchair. So this young lady, spinal muscular atrophy type I, she started with us at 11 months using a single switch. She used our play-and-mobility device. We had a custom-designed joystick that we made for her that was easy for her to activate. It didn't have a lot of what we call throw. You could push just a little with very little force and it would go because of her weakness in SMA. We provided the power mobility interventions in her home and had that led by mom. We came in and did periodic checks and monitoring, but we really found that because of her risk for infection, we didn't want her in our laboratory setting, wanted her to be at home. She was also extremely motivated at such a young

age to be in her natural environment and to play with her brother, her older brother, and her peers when they were in the house. So here's a video of our first session. As we go to that first session, you'll see that her car seat is tipped back. We've tipped her back because she doesn't have any head control. She has very limited movement of her arms, but she is able to activate the switch and you can see she's sucking away on her pacifier there as she's moving the device forward. She was unable to stop. I think that that was probably mostly related to motor inability to lift her hand up off of the device 'cause she seemed to be trying to stop. You could see her trying to move her hand. On the Power Mobility Training Tool that we developed, the PMTT, we differentiate between motor issues and non-motor issues.

So is a child unable to stop because of motor issues or is it because of cognitive issues, and the same for initiating movement of the power mobility device. Is it an access issue or is it a cognitive issue? Heading back to the PowerPoint, this young lady like I mentioned very quickly progressed in her power mobility skills. Again she was at home so she was able to interact and play with her brother. We created a specific power mobility device for her. She used the power mobility device in her unfinished basement primarily at first where she could play with her brother, and here's our first session with the joystick.

As we bring up that video, I want you to notice that she's chosen to go in circles. This is a very common thing for a child who uses a joystick for the first time, they go in circles. If you think about the pure sheer delight and pleasure that a typically developing child will take from spinning, spinning, spinning, spinning, and getting dizzy, you can sometimes see how a child who has never really had the opportunity to move independently might also enjoy that spinning. As we come back to the PowerPoint, I want to have you note that she quickly went from just doing spinning using the joystick to being able to play and interact with her brother. Now like I mentioned, and as you can see in this picture here, they were in their unfinished basement and brother who is

three really, really, really liked to play hockey. So he would play hockey downstairs in the unfinished basement, and she was the Zamboni that would come in and clear the ice. It's just one of my favorite stories about this cute little girl. She very quickly went from being an exploratory learner at 11 months of age to qualifying for her own power mobility device at 19 months of age. She in fact was able to use a loaner device while she waited for delivery of her own chair, which is very unusual in our area. Just all the things happened at the right time and they had a chair that fit her really well and they we're getting a new demo chair so they could loan her the old one and it was just so much fun to see her be able to integrate mobility into her daily life.

She continued to play hockey, though this time she was the goalie 'cause if you can get a puck around that big chair, you've done a pretty great job. Now what I wanna do now is kinda summarize some of the things that we have talked about in terms of learner types and different things that might benefit different learner types. So when we're looking at outcome assessments, and these were only select outcome assessments, for the exploratory power mobility learner, I like the ALP, the Assessment of Learning Powered Mobility Use, the COPM, on the Canadian Occupational Performance Measure, the Wheelchair Skills Checklist, but again it probably depends on the goals, PEDI-CAT, the Pediatric Evaluation of Disability Inventory Computer Adaptive Test, depending on the goals. and maybe according to work from Ros Livingstone and Debbie Field, maybe the PMTT that we developed, the Power Mobility Training Tool, would be an appropriate tool, but it really is dependent on the goals.

One of the things we really want to do is make sure that we're checking in on those goals and making sure that we're making progress towards those goals and outcome assessments are one way that we can look at that. Operational power mobility learners are benefiting also from the ALP, COPM, the Wheelchair Skills Checklist, and the PEDI, but again it depends on the goals. Functional power mobility learners may benefit from the ALP, the Canadian Occupational Performance Measure. The WSC is probably

focusing on skills that are too low-level for the functional learner so we don't typically use it in that group. We could use the PEDI-CAT, but it really again depends on the goals, and I'll go back to that in a second. We typically also won't use the PMTT because again very basic skills that the functional power mobility learner would've already conquered or mastered. We can use a couple of other items. So the WhOM-YP, which is the Wheelchair Outcome Measure Young Person, is an adaptation of the WhOM which is for adults and it's very similar to the COPM, but it focuses exclusively on participation in home and community settings using a wheelchair. It can be done with either children or adults. It identifies goals.

The clinical significance of change has not yet been established on the WhOM-YP. On the adult version, the WhOM, it's a change of two points, just like on the COPM, but that has not yet been established on the WhOM-YP. So for that reason, I tend to use the Canadian Occupational Performance Measure more. In my our conference call yesterday, I learned that manuscripts related to the WhOM-YP are gonna be coming out really soon, which I think will help facilitate use of that tool. That tool can be downloaded for free on the Internet as well. The PEDI-CAT, I have used the PEDI-CAT with children who are functional power mobility users.

I'm not focusing on power mobility skills because even though the PEDI-CAT has a wheelchair skills subdomain within the mobility domain, those are all manual wheelchair skills. I spoke to the developers of the PEDI-CAT and the manual wheelchair skill evidently is consistent with the computer adaptive technology that they use, but the power wheelchair skills, we kinda throw all that off. So there are no power mobility items on the PEDI-CAT. However it's a really great way to see maybe how a child is improving in their social skills, their cognitive skills. Sometimes children are prompted to use motor skills that they have at a lower level that are challenging for them when they're introduced to power mobility because then they understand what they can do with movement. I remember one little boy that I worked with. I would see pictures and

videos of him when he was little trying to use a gait trainer and it was very hard for him and he didn't seem to really understand why people were making him use it. He's crying and tears coming down his face. It was like we we're torturing the poor little guy, but once he learned how to move using a power wheelchair, he seemed to gain more interest in using his gait trainer and he now actually asked for that. He is 12 years old and asked for it. He equates it to his exercise. Just like his mom and dad walk on the treadmill or run on the treadmill for exercise, he uses his gait trainer for 30 minutes a day 'cause he wants to be healthy, and I really love how he does that. Other possible tools for functional learners include the Pediatric Mobility Program, which is from . Again, that's for functional learners.

There are a couple of items on there for exploratory learners and a couple of items on there for operational learners, but I find that it's best for functional learners. The Wheelchair Skills Test for Power Wheelchairs is another option. That's out of Canada. Excellent website, all free. You can download everything, watch all sorts of videos. It has not been adapted for exploratory learners. The tool items will be relevant for operational learners, and then I mentioned the Wheelchair Use Confidence Scale for Children, the WheelCon, developed by Doctor Paula Rushton in the University of Montreal. I'm really excited about that one coming up.

Some power mobility training methods that might be used with exploratory power mobility learners or operational power mobility learners really kinda reflects the children's needs and what they're learning at the different stages. So exploratory learners use activities to promote cause and effect. Even accidental activation of the switch, accidental activation of the joystick has been shown over time to help the child learn that when they touch that switch and they touch that joystick that they are having an effect that causes the movement. Allowing exploration, making sure that as adults we're not having an agenda where we think the child needs to constantly be moving and constantly be going and constantly trying to get objects or whatever. Let the child

just have fun, allowing the child to make choices and decisions, allowing the child to play. Play is a power mobility training method that spans exploratory power mobility learners, operational power mobility learners and functional power mobility learners. It is one method of training that can be used for any child of any learner group, but of course it might look different. Your play with your exploratory learner might look very different than your play with an operational learner. Operational learners like we just said use play. I like a lot of games like red rover, red light green light. In the red light green light, I can get beside the child and I can really exaggerate my movements and do like this exaggerated slow-mo run and the child just thinks it's hysterical 'cause they're breezing by me. They're really focused on operation of the device.

So if I identify that they need to work on turns to the left, maybe I set up my environment so that they have to make all their turns to the left in order to obtain what they want, or to play their game, or to do a follow the leader. Follow the leader's simple. Follow the leader is another play activity I really like with operational power mobility learners and I let the child have the opportunity to both be the leader and the follower. It's really fun, especially if you can get some siblings or other children involved, making sure of course that you can keep everybody safe. Some power mobility training methods for the functional learner.

The Pediatric Mobility Program developed by is a checklist of skills, but you can also train those skills. The Wheelchair Skills Test has an accompanying Wheelchair Skills Program for power wheelchair users that again is available on the website free of charge, and then also just trying to help with participation in daily life activities. Some things I found really successful here or like within the home, the child is hungry and wants a snack, or if it's time to have a snack or time to have a meal, we go into the kitchen or into the dining room, whatever the appropriate thing is. If it's time to brush teeth, let's drive in to go brush our teeth. This to me is very similar to how I introduce functional use of a walker. When I first start, I try not to overwhelm the family by having

the child in the power mobility device or have the child using the walker all day long. I start with one simple activity. Oftentimes I like to have the family pick something that's part of their routine. Maybe they all come together for dinner at the table. So maybe the child is placed in the power wheelchair and they drive to the dinner table or is placed in the walker and they walk to the dinner table or I had a family who homeschool and dinner was always a little bit chaotic for them, but they found breakfast was a great time for them to be able to integrate using the wheelchair in a functional manner, and then kind of gaining activities.

The idea is to help families and children see how they can put it into what they're already doing, not necessarily adding something new in this regard. Again talking about outcome expectations for different power mobility learner groups, just wanna kind of remind us about the practice that might be needed. Power mobility learners who are in those early phases, exploratory and operational, they need extended practice periods. Lisbeth Nilsson in her Driving to Learn program discusses in her articles, her published journal manuscripts related to Driving to Learn that she worked with children for years for them to be able to understand cause and effect and move from that exploratory phase into operational learning activities. So some children will stay in that exploratory learner group, and that's okay.

We've seen children who stay in that exploratory learner group but who gains skills that benefit them in other areas, particularly related to cause and effect and particularly related to switch use. We see the same with operational learners. We need to remember that children who use specialized access methods such as switches, head array, those types of things may require extended practice periods and may need more help as they are learning to use those devices to operate their power mobility device 'cause there's some motor component there, but there's also so much when you're learning how to drive a power mobility device at any level, there's so much visual perception going on. With the functional power mobility learners, we still have to make

sure that our expectations are in line with the environment and new situations and new environments may present new challenges, and again remembering that idea that learning to use a power mobility device is an ongoing process and that continued training may be needed. We also wanna remember that there could be a need for multiple mobility options. We tend to as a society trying to think of things like okay this child either needs a power mobility device or they need a walker and that it's a dichotomous choice. They either have a power mobility device or they don't or they have a walker or they have a power wheelchair, and really we we don't need to think that way. We can really look at a total mobility approach, looking at multiple mobility options for children. So when we look at that, we might think about this little girl, Millie, that I worked with.

Now Millie was just about two when she came to us and she wasn't yet crawling. She was delayed in her gross motor skills. She has a genetic condition and we're really not sure, it's kind of rare, we're really not sure of what her gross motor trajectory would be, but her mom really felt that getting Millie moving was important. As Millie progressed, she continued to use different types of power mobility devices.

So we started her in our play-and-mobility device, and then moved her to one of our modified ride-on toy cars that she could use primarily to play outside in the paved driveway, but at the same time that she was using our play-and-mobility device and progressing to a modified ride-on toy car, she was also learning to use a gait trainer and using her gait trainer outside in her yard, and then soon after that she started using a Kaye Walker. She now uses the Kaye Walker and is taking independent steps on her own, but she still has the toy car that allows her to play outside with her family, chase the ducks, and do different activities using different pieces of equipment. It's rare that a typically developing child or an adult only uses one form of mobility. Today I have worked out. I have walked the dog. I've driven the car to work. Later on I may take a bus because I've got to go to a different part of campus and if I have time I might get in

a bike ride and if it wasn't snowing out. So during a day, we could all use different mobility options. We need to be creative and find ways for our children who have mobility issues to have this same option: to do different forms of mobility using different pieces of equipment. We have a family here in our area that I feel is just highly successful with this and they have purchased limited cost pieces of equipment on eBay or through there's family support groups online have been able to purchase something at reduced cost when another child has outgrown it. So there are some creative ways that we can find different options and multiple options for children. Here are some of my references and more references, and here we're at the point for questions. As you note, the email address is there should you have any specific questions that you didn't get a chance to ask today. If you're watching this as a recording, please feel free to contact me or if you would like a copy of the Power Mobility Training Tool, again we provide that at no cost and we allow people to use it for research and clinical use upon request. I turn things over to Calista to moderate for any questions.

- [Calista] Thank you so much, Doctor Kenyon. We currently do not have any questions, So if you have questions for her, go ahead and place those now.

- [Lisa] Maybe while we're waiting what we can do Calista if it's all right with you, I could maybe review some of the exam questions. Would that be okay? All right.

- [Calista] Yes, yes.

- [Lisa] Okay, yeah. Am I able to read those and go over those? Okay, well then why don't I do that. So one of the questions relates to which general intervention strategy has been successfully employed with children in all three power mobility learner groups. What we did was we looked at use play being appropriate for children in any of the three power mobility learner groups: operational, exploratory and functional. When

we take a look here, like question six, which of the intervention strategies best represents power mobility strategies for children who are exploratory learners, accidental activation of the access method, A is the appropriate answer because that accidental activation is going to lead them to understanding cause and effect. I see we've had a couple of questions come in. Let's see here. Can you give me good advice on how to prepare for the ATP exam? Wow, that's an excellent question. The ATP or Assistive Technology Professional exam is given by RESNA. Power mobility is part of it, but not all of it. RESNA has some excellent resources and some excellent continuing education offerings that help prepare. I know people have also benefited from attending conferences like the RESNA conference or the seating symposiums, the International Seating Symposium or other seating symposium.

Sorry that I don't have a quick answer for you on that one. We had another question here about suggestions on how to get, and I can't quite scroll that one down, how to get, I can't scroll that question down. Calista, could you help me with that one? How to get a child referred for power mobility testing or clinics like yours in other cities or states? So we have a power mobility program. It's a service and research project, but we don't own our power wheelchairs, which is great for me 'cause that means I don't have to do any paperwork, but we also in our area have a great seating and mobility clinic that we refer children to. Usually that requires a physician's prescription. So we go through the physician. The family usually contact the physician and get that going, and then with family permission, we also can share some of the findings that we've had with the children in their training. Oftentimes parents just bring videos of the children working with the power mobility devices. Other areas of the country may not have seating and mobility clinics. I know and when I lived in New England, I did not have a seating mobility clinic near me. I was the seating and mobility clinic. I would work with vendors and get things going. So those things that might be helpful. The follow-up question is, more programs like ours. There are not a whole lot of programs like ours. We are actually working on a federal grant to be able to develop more programs like

ours and fingers crossed maybe we'll be able to do that. I know that some GoBabyGo programs are located working with younger children, usually it's children three and under. Sometimes it's five and under, but there's not necessarily the follow-up. It's usually a GoBabyGo build, getting the device, and then the families using that. There are some other research centers, but may not have ongoing research activities. Fingers crossed on that grant and hopefully we'll be able to have more programs available for more children in more parts of the country. Thanks for the fingers crossed. I really appreciate that. Any other questions here in the last little bit? Calista, did you have any questions in our last 20 seconds? Oh, one just popped up. When a child gets frustrated, uncooperative with the power mobility training, I can't read the rest of it.

- [Calista] What do you do to help them?

- [Lisa] Oh, okay. Okay well I think some of it has to do with reading the child. If the child is tired or hungry, this is a really challenging activity for a lot of children and sometimes for the younger children, 15 minutes is all they can take and if you go to minute 16, they're gonna have a temper tantrum. So kind of looking at that aspect, and then also kind of looking at our own verbiage and the verbiage of adults around us. Are the adults around the child giving the child directions, turn here, go here, do this, do that, and that can be overwhelming for a child. So maybe some of the frustration or not being cooperative relates to the child feeling overwhelmed. Lisbeth Nilsson talks a lot about how many times when a child is frustrated or not cooperative or acting out with a power mobility device, we should look at ourselves first and the adults around the child first before blaming the child 'cause it's probably something that we're doing and maybe not necessarily aware of. I hope that helps to address the question. Also if the child's motivated and having fun, that's why we try to identify things that they really like. So a child who's bored is more likely to act out. Thank you for that question.

- [Calista] Today's course. Thank you again, Doctor Kenyon, and have a great day, everyone. I'm gonna go ahead and close out today's course.