

Building Executive Function Skills in Children and Adults
Front Porch Series Broadcast Call

GAIL JOSEPH: Welcome to another installment of the National Center for Quality Teaching and Learning Front Porch Series. And on behalf of my colleagues at NCQTL, I'd like to thank all of you for joining us here today. For those of you who are joining us for the first time, the goal of our Front Porch Series is to feature national experts who are doing innovative and applied work to improve the quality of teaching and learning and in turn to improve the outcomes for young children and their families. And today's topic, which is very exciting to me, is about executive functioning not only in children but in adults. And we are joined today by Dr. Juliet Morrison.

So let me tell you just a little bit about Juliet. Juliet is someone who I've come to know very well and enjoy greatly. She is here in Washington State right near the University of Washington, where NCQTL is kind of housed, if you will. And Juliet oversees the Washington State Professional Development System and the implementation of Washington State's quality rating and improvement system that is called Early Achievers. And in that role, she makes sure that early learning professionals have the support and incentivized training and education opportunities that help them really offer high-quality early learning to children. So essentially kind of moving—moving that bar on the quality of teaching and learning in Head Start, Early Head Start, state pre-K programs, as well as in child care and family child care. And she previously was the director of education for the Seattle Children's Museum, which is very fun to know about her background in that capacity as well. But she also has a doctorate in clinical psychology and so has worked as a therapist as well and specializing in the treatment of children, adolescents, and families. And so she's got this great, rich background. And what I love is that if you look up her bio, she also mentions what her favorite children's book is, which I think we should do that for all our presenters. And hers happens to be "Wilfrid Gordon McDonald Partridge" by Mem Fox, which is so fun.

So I have been—like I do for all of the Front Porch Series, but for this one in particular, I've really been looking forward to learning more about the topic, because especially this topic, which is executive functioning, which I think a lot of us have heard in the field and maybe know a little bit about, but not kind of the full extent to understanding executive functioning as I think we need to. Now, we all know that executive functioning isn't called out specifically in the Head Start Child Development and Early Learning Framework, but I think after you hear Dr. Morrison talk about it, you'll understand that there are elements of that kind of strewn throughout in approaches to learning and in cognition, as well as some social-emotional development. So I've heard Dr. Morrison a few times now explain what executive functioning is and how early learning providers can and do support it kind of in everyday life. And so I think there's no one better to have us—to join with us to talk about this topic.

And so before I turn it over to Dr. Morrison, let me just remind you that, as always, we save a few minutes at the end to field your questions, so feel free to send those in throughout the presentation using the question bar and then know that we will have some time at the end to address those. So without further ado, I will turn this over now to Dr. Juliet Morrison.

JULIET MORRISON: Thank you so much for that lovely introduction. And it's so nice to be with all of you today. This is one of my favorite topics to talk about, and so I hope we can cover a lot this morning and keep the conversation going nationally about how we support children's executive function development.

So I just kind of want to start by giving you an overview of what I hope to accomplish and get in today. And first I want to frame this work by saying that the Department of Early Learning in Washington State is working on executive function and early brain and biological development in a partnership that we call Frontiers of Innovation. Frontiers of Innovation is a partnership of philanthropists, policymakers, and researchers across the United States who are really interested in how do we dramatically improve child outcomes given the science of early learning and what we continue to learn every day about early brain and biological development? And that work is headed up by the Center on the Developing Child at Harvard, so you'll see some information today that is information that Harvard has put together to frame this topic of executive function. In Washington State, we've been doing a lot of work to embed this concept and these ideas about early brain and biological development into our professional development system so that our early learning work force continues to understand the role that they play in supporting children's executive function but also can recognize that they're already doing so much of this work every day and that this might just be a new sort of lens to see the work through. So today I'm going to talk about what does this term mean. It's not a very friendly term, so I hope that we can break it down in a way that makes sense for people. And then I'm going to talk a little bit about how executive function develops, why this concept is even so important. It's particularly important to the conversation around school readiness. How can it be both derailed and supported? And then some specific things at the end about what we know from research about supporting children's executive function skills in the context of early learning environments.

So let's start with what are executive function skills. Many of you might have heard this term, "executive function," before. And actually, it might be defined a little bit differently in different audiences. So today I wanted to talk about it in specific language that's around three specific elements that come together. And the first is inhibitory control. You might also hear of this called effortful control. Inhibitory control is the skill that we use to master and filter our thoughts and impulses so we can resist temptations, distractions and habits and really to pause and think before we act. So you'll see a picture on the screen of a child who's sitting in front of a marshmallow, and this is about a famous study where children were asked to sit before a marshmallow, and somebody would say to them, "You can have one marshmallow now, or you can wait—I'm going to leave the room—and when I come back after a period of time, you can have two marshmallows if you don't grab that one right away." And children were given sort of a bell, and they could ring if they just couldn't wait anymore. And what this really was testing is this notion of inhibitory control. It can be defined as the ability to resist a strong inclination to do one thing, like take that one marshmallow. Instead, think about what you might want to do that's more appropriate. So what's that end goal? And as you know, children are working on this every day. And adults also work on this.

The second element of executive function is called working memory. Working memory is the capacity to hold and manipulate information in our heads over short periods of time, and it's another element of executive function. So when you think about it, it's not just about remembering information. It's about holding that information in mind and then working with it. So although you can't repeat after me, I'll ask you to just kind of think in your head. I'm going to say a series of numbers, and just think about repeating those in your mind right after me. So 1, 7, 9, 4. Those are the numbers. So that's memory, remembering what that string of numbers is. But now I want you to think about repeating those same numbers in your mind, but ordering them from smallest to greatest. So in your mind, you would think 1, 4, 7, 9. And that is working memory. It's taking information and manipulating it in your mind and then using it. And of course children need to remember many steps and rules involved in their world, and that often requires remembering and using information in new situations. So you see

here a picture of a child who's working on a long division problem. So remembering all the steps that go into a particular area of learning.

And then the third element of executive function is called mental or cognitive flexibility. And this is the capacity to nimbly switch gears and adjust to changing demands, priorities or perspectives. It's what we use to apply different rules in different settings and then to catch mistakes and fix them. So, you know, adults again use this every day. If we're driving and, you know, we have a route that we go every day and we come upon a "Road Closed" sign on our normal route, we have to think really quickly about how we can find another way home. It's the skill that we call upon when we're playing a game, as you see here with this child who's playing a game of chess, and it looks like he was surprised by that move that his opponent made. So having to think of a new strategy on the fly, that's exactly what mental flexibility is, and it's a fairly advanced skill for young children and develops later than both inhibitory control and working memory.

So executive function skills do not happen in isolation, though. So those are three basic elements, but what I want to kind of convey is that it is rare that we would call upon one executive function skill and not also call upon other skills. And the Center on the Developing Child at Harvard has a nice metaphor of thinking about executive functioning as sort of the air traffic control system in the brain. That it really captures a set of skills that are increasingly understood as the biological foundation for successful learning and social relationships. So if you think about air traffic controllers, they have to manage a variety of different planes that are coming in on different runways, and they have to have exquisite timing to the whole process. And that's really what executive functioning is. It's these group of skills that help us manage multiple streams of information at the same time, set goals, make good on those plans, make decisions in light of the information that we have at hand, and then revise those things if things don't work out exactly as we planned.

So if you think about it, these skills are also something that we need to call on every day. So here's an example that could happen every day. Think about a mother who's coming home, she needs to get dinner on the table, but the phone is ringing and her kids are asking for help with their homework, and then the dogs are barking at the back door. And so what she needs to do is to quickly prioritize and plan how she's going to deal with all of these multiple distractions happening at one time. So she remembers that she's going to check the phone messages when dinner is over. She lets the dog in, but she knows just where to pick up with the meal preparation despite the interruption. She asks her children to do what they can until she can get dinner in the oven. And so what you see is this involves that she has to focus, hold, and work with information in mind, filter distractions, and switch gears. So that really is like an air traffic control system in the brain managing lots of things and really working at just the right timing. And that's kind of like daily life. Executive function skills tend to be invisible when they're working really well. But when they're not working, of course, that's when things become very evident.

So for children, this might look a little different. Think of a situation where a child needs to take turns. This pulls really heavily on exactly these skills of executive function. First the child has to have inhibitory control, because she needs to be able to stop what she is doing and let another child take a turn. And then she needs to inhibit the urge to keep going with her turn. So there's that inhibitory control. But when it is her turn again, she needs to remember what she was doing, she needs to remember the rules of the activity or game and just where to pick up. And that pulls on working memory. And then if you think, what if her partner does something unpredictable or unexpected? She

also needs to be able to adjust her plans to fit into the flow of this new development, and that requires mental flexibility.

So I'm going to show you a graphic of how executive function develops over time. Here's sort of a graphic representation. And one thing to point out is that we are not born with executive function skills in place. We're born with the potential to develop them or not, depending on our experiences, our neurophysiology, and the interactions between those things. This graph shows—on the horizontal axis, you can see this is ages birth to 80, and notice that there's not an even distribution between the ages. And that is because there are particular peaks in executive function development. So you can see skill proficiency on the vertical axis. And I'm going to highlight a couple of areas where you see tremendous growth in executive function skills, and that is really in the preschool ages between 3 to 5, and then in early adolescence to early adulthood, there's another kind of spike in development. So the foundations of executive function are laid down in the earliest months and years of life, and that really happens through basic sort of serve-and-return, it's sometimes called, or those basic interactions between child and adult that happen over and over and over again. And that spike really does happen in the preschool years after children have verbal language. And that spike in adolescence is something also that's really important to pay attention to, because executive function skills don't really fully mature until early adulthood. So what we know is that there are particular ages where it's really important for us to focus on executive function development, but what we also know is that if children don't develop these skills later on for whatever reason, and we'll talk a bit about that, there's a lot that we can do to intervene early or even later to ensure that children have those executive function skills in place for the complex dynamics that happen in everyday life that tend to get more complex, obviously, as we get older.

I want to show just a couple of examples so you can have some concrete things to think about in terms of development over time. So you see here, here's a chart that shows infancy and the preschool years and then adulthood with the three elements that we've talked about, working memory, inhibitory control, and cognitive or mental flexibility. So here you can see that starting as early as the second half of the first year, these skills are beginning to be learned. And a 1-year-old is more capable of complying with an instruction, for instance, to not touch something, so inhibitory control, than a 6-month-old would be able to. And then obviously as children get older, you know, you think about sort of that classic test of covering something that an infant really wants with a cloth, putting it over a pair of keys, and then that infant remembering that there's something under there, so I'm going to take that cloth off—that idea of object permanence—and I'm going to find those keys. And that's really about working memory. So these skills are developing in the earliest years of children's development, and it's pretty amazing when you think about the accomplishments that happen over such a short period of time.

And then think about a child who is 4 years old who's in preschool and then has to think about following multistep direction. So a child comes into a classroom, and the teacher says, "Hang up your backpack, pick a book from the book basket, sit down for circle time." And that really calls on working memory and inhibitory control. So a child can't go run to an area successfully that is not the book area or the circle time and has to remember, "What do I do when I come into the classroom every day?" And of course, that's helped if a child has a predictable routine. Now, if a teacher says, "Today we're going to start with water play instead of at circle time," that child also needs to be able to shift from the routine that they've come to know over time, and that requires cognitive flexibility.

So this term executive function is being talked about a lot more, and particularly is being talked about in the realm of ensuring that children are ready for school in the K-12 system, because this really is

more and more as we learn the biological basis of school readiness. So think about things like attention, following all the steps that are required of academic learning, and even social skill development. These skills really matter hugely for all of the things that children are going to learn throughout life. That if you can't sit and attend to information and filter out the multiple distractions that happen in a classroom setting, it's going to be very hard to engage in learning. So again, we're really thinking of these skills as being critical for children to develop the cognitive skills that go along with some of the base social-emotional skill development.

In terms of social skill building, you know, I want to give another particular example, because executive function, it impacts learning, but it also plays a very, very critical role in getting along with peers. So consider a group of young children who are acting out a play. Maybe they're acting out the play of "The Three Bears." They have to come up with a plan for a play in their play together. They need to assign characters, for instance, and remember what their own role is and what the role of others are. They need to keep track of what everybody is doing and insert their piece in the story at the right time. And if one child misses a beat, they need to readjust what they're doing and so on and so forth. And it becomes a very complicated, yet to the average person maybe invisible piece of all that's happening behind the scenes in this mental balancing act between what's going on in each child's head throughout something that's as seemingly simple as playing out a role. And of course this also is really important to just social cooperation among peers. For children who might have problems inhibiting their initial response and tend to get, let's say, aggressive or, on the contrary, tend to withdraw, this is a very important component of ensuring that children are working well together. They know how to enter into conversations, they know how to take turns, they know what the response should be if something happens that's unexpected. All of those things are key to social skill development as well.

Another reason why executive function is so important is because there are many, many studies that show that low executive function skills predict problem behaviors later, things like delinquency, drug dependence, health problems, criminal behavior, those things that we're really trying to deter from early intervention. And that these things hold up regardless of socioeconomic status. And that even above IQ, executive function skills tend to predict these things later in life. And then finally, something that I've alluded to is that executive function is so important not only because it contributes to all of this—these learnings that have to take place in terms of cognition and social-emotional, but also because we know that these skills can be strengthened. So again, for those kids who might be struggling early on, there's a lot that we can do as early learning providers to ensure that they have time to practice and strengthen these skills.

So before I go on any further, I wanted to just kind of touch base around early brain and biological development and how that connects to executive function. You know, a child's experiences during the earliest years of life have a lasting impact on the developing brain. And while genes provide the basic blueprint, it's really those experiences that shape the process that determines whether a child's brain will provide a strong or a weak foundation for all future learning, behavior, and health. And so the first concept I want to talk about is that brains are built over time. So I talked about executive function developing over time, and this is particularly relevant to executive function where simple circuits are laid down first in our brain, and then they provide the foundation for more advanced circuits and skills later. When it comes to executive function, the specialized areas of our brain that are involved are the frontal lobes, the front part of our brain, and in particular the prefrontal cortex, which are among the last of the brain regions to mature and are specifically involved in the development of executive function. So when you think back to that graphic that showed the development of executive function skills over time, that really does make sense that we are still learning and really shaping that area of

our brain until early adulthood. Also, advances in science are really starting to deepen our understanding of how healthy child development occurs, how it can be derailed, and what we can do to keep it on track. And what we learn more and more and more is that early experiences and the role of interactions and relationships cannot be underlined enough. That early experiences in a child's life can leave sort of a chemical signature, if you will, on our genes that determine whether and how the genes are turned on or off, and that this interaction literally shapes our brains. So the work that all of you are doing every day, the ongoing interactions between children and their adult caregivers, that is really the active ingredient in building healthy brain architecture.

Another thing that we're learning a lot about is the role of something termed toxic stress in the developing brain, and specifically around executive function skills. And what I mean by toxic stress are environments where children undergo chronic heightened stress. And that might be instances of children witnessing violence in the home, for example, or instances of chronic abuse or neglect. That that type of cumulative, reoccurring chronic stress can really sustain a cumulative wear and tear on the biological systems of the body, and that over time, this exposure begins to break down or change the functioning of those systems in ways that can lead to disease and to disorder. In particular, toxic stress tends to impact executive function skills quite a bit. That what it does is produces a high level of a hormone in our brain called cortisol, and that that impacts the prefrontal cortex development. So those areas of the brain that are involved in executive function are really the first to suffer. And if you think about it, if we're lonely, sad, stressed, sleep-deprived, all of those things that happen on a normal kind of—you know, in the normal development of life, when those things are really heightened, it impacts our ability to do those things that we've talked about with executive function. So to remember, to recall information, to inhibit our emotional responses, those things become taxed even when we don't get enough sleep.

But what we also know is that the plasticity of our brains is pretty amazing, and that we can intervene throughout childhood, adolescence, and even early adulthood to build executive function skills. That it's really these experiences and activities that can change the brain throughout life. So they can be improved, which is something that is particularly hopeful for children that we know are living in environments of toxic stress. Children who live in health-promoting environments can really—that can be a buffer against effects of stress in general. But also, you know, those children who might be experiencing difficulties outside the classroom environment, having a health-promoting environment can really do a lot to buffer against the effects of toxic stress. And what we know is that children who live in health-promoting environments, have positive early experiences with adults, tend to go on to complete more years of school, have higher-paying jobs, have healthier lifestyles, and live longer, while children who experience significant adversity, especially early in life, without that buffer, so without a consistent support from caring adults in their lives, are more likely to drop out of school earlier, earn less, depend more on public assistance, adopt a range of unhealthy behaviors, and live shorter and less healthy lives. So it really is critical that in these early years, we intervene to ensure that we give children and families the support that they need.

And then when you think about this in the classroom environment, executive function is an interesting concept to think about. A child who may be aggressive may not be doing this intentionally. A child who has trouble remembering information or following the rules that happen every day, perhaps it is not that child being intentionally disruptive or presenting challenging behaviors. It may be the case that this child's executive function skills are not online in the way that we hope them to be. So how can we as adult caregivers intervene and support those children and families to ensure that we're building that capacity over time?

So I want to turn now to how do we support executive function development? And I want to start first by talking a little bit about adults, and I'll try to run through this quickly. Again, going back to how executive function develops over time, one of the things that we also know is that sometimes adults don't have executive function skills that are either fully developed or are working very well. So you probably all can think of adults in your lives that may have some, you know, issues with their own executive function capacity. But when we're thinking about working with children, and in particular thinking about the importance of that adult/child relationship, the first thing that we need to think about in terms of supporting executive function in children is really thinking about building adult capacities in executive function. And I put here some competencies that we know are really important to provide that nurturing and caring foundation as adults. And you won't be surprised that all of these are about healthy executive function development. So recognizing and managing emotions, developing caring and concern for others, making responsible decisions, establishing and maintaining positive relationships, and handling challenging situations effectively. That really does call upon our executive function skills. And they require self-reflection. And we have to have our own inhibitory control when we're working with children. We have to be able to model the skills that we want them to develop. And that sometimes when adults do not have a handle on their own executive function capacities, that can interrupt supporting children's developing executive function skills.

So the first step in ensuring that as a nation, as a system that we are supporting children, I think first we need to look at the adult capacity. Where do we need to strengthen our own skills, how do we support each other in communities of practice to look at these things and to have time to reflect on those things that might be impacting what we're modeling and supporting in children? And then just to talk specifically about some things that have been shown thorough research to be really important in supporting children's executive function development. And many of these are not new concepts. They're things that you're doing every day, but maybe just something to think about when you're thinking about specifically executive function skill building. So much of this is taken from Adele Diamond's research on how do you support executive function skill development within an early learning system, within a classroom environment? And, you know, some of them are probably not going to be a surprise.

The first is really being able to be fully present and to listen to children without distraction. So that goes back to that concept around building adult capacities, that in order to successfully read children's cues, observe where they are, and then respond in a way that is promoting and scaffolding their learning, we need to be able to kind of shut away the noise of our own minds and really be in there in the moment with children. So really quickly, I just want to read a quote from Scott Peck on "The Road Less Traveled," which I think is a beautiful quote that speaks to this. "True listening, no matter how brief, requires great effort. First of all, it requires total concentration. If a parent wants to truly listen to a child, the parent must put aside everything else. If you are not willing to put aside everything, including your own worries and preoccupations for such a time, then you are not willing to truly listen." So one of the base things to support children's executive function skills is to really be fully present in the moment with each child. And that's really complicated when you have 20 children in one environment.

The second thing is about reducing stress. And that's reducing stress in both adult lives—so making sure that adults make time to exercise every day, to do things like practice mindfulness, to make sure that they get enough sleep—and then also reducing stress for children in the learning environment. So doing things like creating a safe environment through predictable routines, allowing children to know

what to expect, providing clear expectations and consistency where things have their place. And then also there's a lot of work that's being done around mindfulness in children and how can we modify some of the things that we do for adults and allow children to also practice periods of being fully present and in the moment and reducing stress in the environment?

Another really important concept is allowing time for practice. So we all want our children to do well, but if they feel pressured or pushed or that they feel shamed around making mistakes and don't feel that they always have the opportunity to try things out, it creates a stressful environment. So one of the things that we want to do in light of, you know, daily schedules and getting all that we want to do in a day crammed in there, we also want to make sure that there's sufficient time for children to practice and then master skills. And that they can practice and learn through mistakes, learn through failure, if you will, in a way that doesn't feel like a failure. It's a mode of learning. So allowing them both the time and space, and then also allowing time for them to self-correct over time.

Another thing that really builds executive function skill is basic turn-taking that I already mentioned, and in particular, supporting very engaged play. So deep play where children sort of take on roles and are deeply engaged are one of those things that call upon all of the executive function skills and often happen in sort of an organic way where children have to respond to other children and read their cues and signals, remember what they were doing, and then, you know, shift with changing priorities or perspectives.

I've mentioned sleep and exercise, but then in terms of learning and activities in the classroom environment, there are many things that people do every day where they scaffold learning. And that really does also support executive function skill development. So observing children, knowing where they are along that developmental continuum, and then offering them just a bit more by using either visual cues or, you know, pairing them in pairs to kind of learn with each other, that that kind of scaffolding learning supports executive function development. As well as particular games and activities that call on those skills specifically. So think of games that you might have done when you were young, things like red light/green light or Simon Says, games with songs where children have to remember and then move their bodies. Physical activity in general tends to be a way that you can support executive function skill development in children. So again, there are things that teachers are already doing in the classroom to support these skills and are often using them as things like transition from activity to activity that really do support executive function skill development in children.

What the Department of Early Learning is doing is that we are creating communities of practice for practitioners to really dive more deeply in how they can support children's executive function development. So we are very interested in learning from the field as much as we are providing information about research so that people can begin to see that this is work they're already doing, but when you view it through the lens of biological school readiness and supporting those kids particularly who have room to grow in terms of executive function development, there's a lot we can do in early learning environments every day to really strengthen these skills and position children for future learning, health, and social success.