Play By Play

The DSCN Lab Newsletter

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Parenting Stress and Executive Function

By Rebecca Distefano

Research has found that parents play a key role in the development of executive function (EF) skills. EF skills are cognitive processes that are important for planning and problem solving, and have been linked to academic success. One particular type of parenting behavior, called autonomy supportive parenting, has been shown to support EF development. Autonomy supportive parenting is characterized by allowing a child to work at his/her own pace, providing help only when a child needs it, and structuring a task in a way that matches a child's skill level (e.g., suggesting a child find the edge pieces first on a challenging puzzle if he/she is having trouble). While these parenting behaviors support EF development, little is known about the individual and environmental factors that influence if and when these behaviors are used. The current study explored if individual characteristics of parents and life stressors impact the use of autonomy supportive parenting. In the study, 3-year- olds and their parents were assessed on a number of EF and other cognitive tasks. Parents were also given scenarios to read to remind them of potential stressors in their lives. We hypothesized that parents who were given a highly stressful scenario to read would provide lower levels of autonomy supportive parenting compared to parents who were given a less stressful scenario. Because autonomy supportive parenting requires patience, self-control, and keen attention to a child's needs, which are all impaired by stress, we predicted that reading highly stressful scenarios would impact the use of autonomy support. After parents finished with the scenarios, they reunited with their 3-year- olds to work on a difficult puzzle together. Researchers then coded the videos of the parenting session for autonomy supportive behaviors. An example of an autonomy supportive behavior would be a parent who allows a child to put pieces in for him/herself, but provides suggestions for which pieces come next if the child needs help. We did not find differences in parenting behaviors for parents who received the highly stressful scenarios compared to parents who were given the less stressful scenarios. It is possible that the scenarios were not relevant to many of the parents in the study, or that parents in both the high and low stress groups experienced similar levels of stress. We are currently designing a follow-up study to explore these possibilities further. We also examined individual characteristics of the parents to determine who is most likely to provide autonomy supportive parenting. **We found that parents with higher EF were more autonomy supportive, even when controlling for IQ**. This suggests that one way to support child EF development may be through bolstering parent EF skills. If we work to improve parent EF skills this may improve autonomy supportive parenting, which in turn could help child EF development. In the future, it will be important to examine if improving parent EF skills directly leads to increases in autonomy supportive behaviors.

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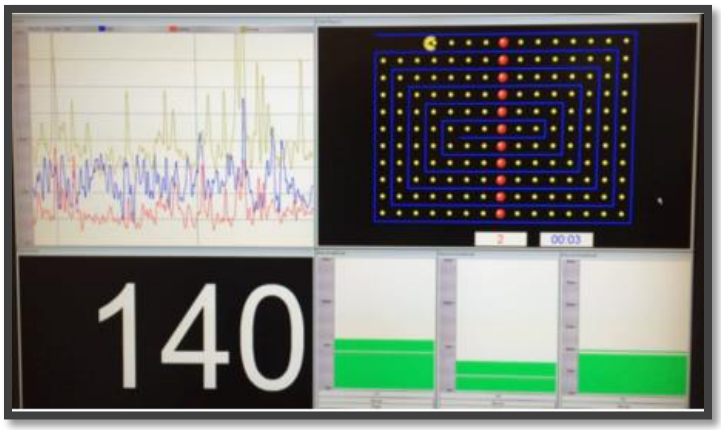
Executive Function & Neurofeedback Training

By Brandon Almy

The Carlson-Zelazo lab recently wrapped up a preliminary study on executive function and neurofeedback training with children age 9-12. We collaborated with local businesses LearningRX and Koronis Biotech on the study. Neurofeedback training allows a child to see their brain activity in real time using sensors attached to their scalp. The sensors are able to pick up on brain activity that is associated with sustained attention. The sensors are attached to a computer that allows the child to see this brain activity in real time with a bar that changes color. The bar is green when the child is producing brain activity associated with attention, and it turns red when a child is not producing this activity. An example of neurofeedback in action is the Pac-Man game used in the training sessions [picture to the right]. If a child is focused, Pac-Man moves on the screen and the bar is green. If a child is not focused, Pac-Man stops, the bar turns red, and a trainer asks the child to re-focus. With repeated practice, children may be better able to focus and sustain attention, which in turn could improve executive function skills.

We investigated whether 10 weeks of neurofeedback training would have effects on a measure of neural activity (we recorded brain activity at rest using electroencephalography (EEG)) and a behavioral measure of cognition. The behavioral measure involved vocabulary, different types of memory, and executive function skills. Children completed the measures before training and again after. In all, 13 children received neurofeedback training and completed the neural and behavioral measures. These children were compared to a group of 12 children who completed the same measures but did not receive neurofeedback training. Data are still being analyzed, especially some parts of the neural data as it takes a lot of time to clean and process the information, as well as data collected during the actual training. At this stage in the analysis, when the two groups are compared, we do not observe changes in the behavioral measures or neural activity between the children in the training group and those in the control. While this was unexpected, it does appear that the training did work for a couple of children, just not for the group as a whole. From a feasibility standpoint, most of the children completed all of the training sessions and parents mentioned that children enjoyed the training. Importantly, the pilot study provided us with valuable information that will help us understand why the training did not work on a group level. The results have raised a number of questions that the data will help us begin to answer. Moving forward, we hope to use this information to modify and improve the training for the next potential study. We greatly appreciate the participation of the parents and children!



A picture of the computer display during neurofeedback training. The green bars indicate that the child is producing brain activity associated with sustained focus.

EF & Math: Does Training Help?

By Emily Prager

Recently we have begun to explore how self-control skills might relate to mathematical understanding in young children. Previous research has shown that self control skills, also known as executive function (EF), are related to success in school, from preschool through college. Math seems a particularly important area where these skills, including inhibition, thinking flexibly and keeping information in mind, might be helpful. For instance, when students are first learning multiplication they must inhibit their previous understanding of addition (e.g. 3 + 3 = 6) and instead remember multiplication facts (e.g. 3 x 3 = 9). Importantly, both EF skills and number skills begin developing at an early age and establishing a strong foundation in these areas can be beneficial even many years later.

Our current study has looked at how EF and number skills can be improved both separately and in combination. We worked in the lab and with area preschools to train preschoolers in one of four conditions, EF only, number only, EF and number in combination, and story book reading (our control group). Prior to starting their training children were measured on their current levels of EF and number skills and then they are measured again after the training. For all the groups the "training" consists of playing short games where children either sort cards, count dots or count pictures. The games are brief and meant to be fun and exciting for the kids.

After almost a whole year of recruiting participants and working with children and families we completed our data collection. The results of this study showed that each of the three training conditions (EF only, number only and EF + number) showed improvements on skills at post-test (when they were measured again after the training). This means that our training worked! Most interestingly, we also found that the children who received the EF training also showed improvements on their number skills and the children who were in the number training group had increases in their EF skills! These results suggest that these skills share a bidirectional relation and improving one can lead to improvements in the other. We hope to continue to explore this relation with older children and looking at other math skills besides counting.

THE UMN ICD PARTICIPANT POOL

What is it?

The IPP is a central database for over *twenty* faculty-led research labs within the Institute of Child Development at the University of MN.

PARTICIPANT POOL FAST FACTS

6,000+

In 2015 alone, over 6,000 new participants were enrolled in the IPP and it now contains over 80,000 children from the Twin Cities area!

180+

In 2015, the IPP provided over 180 participant lists to ongoing studies within the ICD!

JOIN US!

Enroll your child in research or update your information by visiting:

http://www.cehd.umn.edu/icd/research/ipp/

The Rock Band Study

by Alana Anderson and Sammy Perone, Ph.D.

Early childhood is an exciting time for children's developing thinking skills. Their ability to keep information in mind, pay attention, and think from multiple points of view – called executive function - is improving rapidly. Children are also getting set to embark on the long journey that is elementary school, where these executive function skills are important for their success. School is also the place where they will do a lot of learning.

This study is investigating how executive function skills and learning are related in the video game Rock Band 3. Rock Band provides a rich learning environment much like those children face in the real world. For example, the game has many different songs and difficulty levels that challenge children to learn. The game also challenges children's executive function skills. For example, to play a keyboard in the game well, children have to focus their attention on just hitting one key at a time and focus on playing a song all the way through. The game also provides feedback for improvement using points and stars, which can help children to think about how to improve their performance.

Five-year-old children visited our lab and participated in tasks that measure their executive function skills. Children were then taught how to play a keyboard in the game. Each child then took home the video game where they were free to explore a set of songs for 4 30-minute sessions per week for 10-weeks. Children then returned to the lab where they again participated in tasks that measure their executive function skills and played several songs to show their newly acquired Rock Band skills.

The results showed that children significantly improved their ability to play the keyboard. The results also showed that children's executive function skills improved after playing the game. This raises the exciting possibility that gaming might be used as a platform for helping children develop their executive function skills. Interestingly, we found that children had their own unique way of exploring the game. For example, some children liked to play the game on difficult levels. This really challenged children to learn to play the keyboard. Other children liked to play the game on easier levels and practice the same song over and over again. This really helped children learn to play these songs well. We are now starting a second study to explore if children can improve their own learning by evaluating their own performance and setting goals to improve their performance.

Stay tuned for an update on the study results!

The Batman Effect

by Emily Prager

Every day, children and adults are confronted with tedious tasks that are boring, but still beneficial. From sounding out words when learning to read to paying bills, persisting is an important skill in many aspects of life. The ability to maintain focus and push through on these tasks is only made harder by the constant temptations that are present in our everyday lives. From T.V. to computers to the internet, children and adults are regularly confronted with compelling distractions.

The skills to persist on these tasks despite the many distractions begin to develop in early childhood as self-control abilities increase. Recently, we have designed a study to try to better understand these skills and how they might be improved. To best study persistence and self-control in a real-life way we created an experiment where 4- and 6-year-old children were given a boring task on a computer that they were asked to complete. They were also told that when they wanted to they could take a break on a nearby iPad and play a fun game. Not surprisingly, young children spent 67% of their "work" time playing on the iPad!

One way that our lab has tried to improve persistence is through psychological distancing. Psychological distancing involves taking an outsider's view of your own situation, thereby creating distance between the problem and yourself, making it easier to solve. We hypothesized that the greater distance children could achieve, the longer they might be able to persist on the boring computer task before switching to play the tempting iPad game. In our study, participants were assigned to one of three conditions, where they were told to approach the problem from the first person (e.g., am I working hard?), the third person (e.g., is Emily working hard?) or as an exemplary character (e.g., is Batman working hard?). In the exemplar condition children were given costume prompts and stickers to help them pretend to be their chosen character.

Our results showed that the older group of children in the exemplary character group spent the most time working on the computer, more than children in the other two groups. Currently we are working on additional studies to look at what components of the character are the most important for children to continue working hard. Check out other articles in our newsletter to find out more!

A New Measure of Emotional Facial Stimuli

by Alyssa Meuwissen

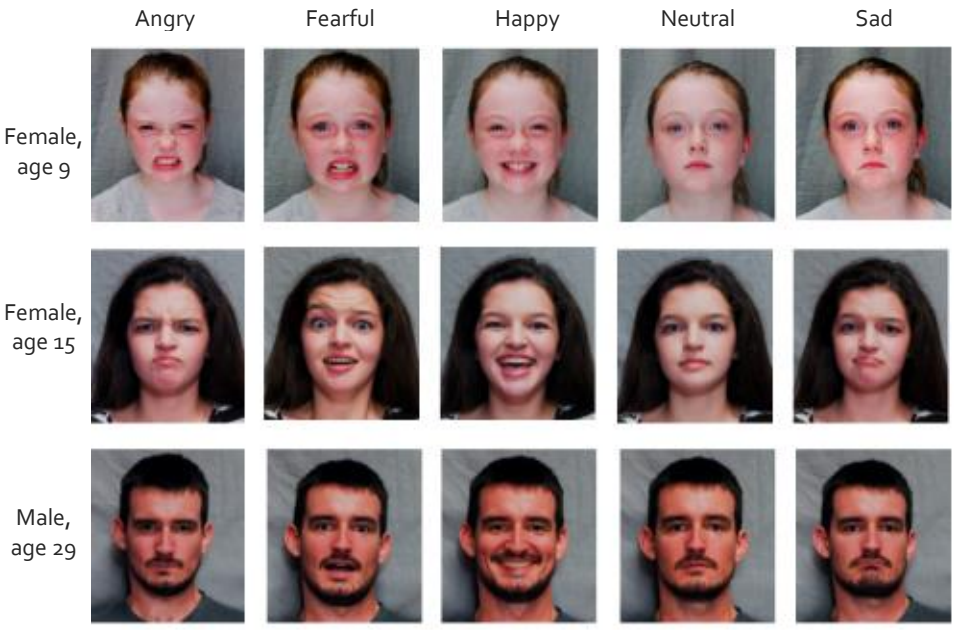
Alyssa Meuwissen and Dr. Zelazo have developed a set of pictures of children and adults displaying different emotional expressions, called the Developmental Emotional Faces Stimulus Set (DEFSS). This set of pictures was created to be used by researchers in a variety of studies to answer developmental questions about emotion.

The final DEFSS includes 404 validated photographs of people between the ages of 8 and 30 years old displaying 5 different emotional expressions: angry, fearful, happy, neutral, and sad. Strengths of this study include a large number of photographs, inclusion of both children and adults, and standardized eye placement, which makes them more useful in studies using neural measures.

Creating the DEFFS occurred in two stages: obtaining and then validating the photographs. Photographs were taken at two locations: the University of Minnesota (35 participants) and the Minnesota State Fair Driven to Discover building (81 participants). Each participant was asked to make a face expressing each of the 5 different emotions. Photographs were cropped and standardized. The photographs were then rated to make sure that they were valid, good representations of the emotions they were meant to portray. Validation was done in three settings: the University of Minnesota (35 participants), the Minnesota State Fair (81 participants) and via an internet-based survey (172 participants). Participants who validated photographs looked at a number of different photographs, and for each identified which emotion they thought it portrayed and rated the intensity of the emotion expressed. Seventy percent of the photographs taken were considered valid and included in the final set.

The DEFSS is a great tool to examine the development of emotion perception and processing and is now available free of charge to researchers at www.reflectionsciences.com.

See some examples below!



Example sets from the Developmental Emotional Faces Stimulus Set (DEFSS)

GRANTS, HONORS, & AWARDS

Alyssa Meuwissen was awarded an ICD Departmental Small Grant for her research on Executive Functioning. She has also received a Doctoral Dissertation Fellowship! Congratulations, Alyssa!

Brandon Almy was awarded a grant from the Center for Neurobehavioral Development for a study on *Adolescent Decision-Making* for 2016-2017! Congratulations, Brandon!

Rebecca Distefano received an Honorable Mention for the NSF Graduate Research Fellowship! Congrats, Rebecca!

Post-doctoral student Sammy Perone is now an Assistant Professor of Psychology at Washington State University! Congrats, Sammy!

Emily Prager, Ph.D. successfully defended her dissertation and graduated! Currently, she is completing her School Psychology internship with MPLS Public Schools and will earn her Ed.S. degree in the Spring of 2017! Congratulations, Emily!

Erin Schubert, Ph.D. graduated! She has taken a position as the Director of Outcomes and Evaluation at the Sojourner Family Peace Center, serving children and families affected by domestic violence. Congrats, Erin!

WELCOME TO THE LAB!

Julie Vaisarova
Julie graduated from Scripps College in 2014 with a B.A. in Psychology. Her research interests include cognitive development, pretend play, symbolic representation, and creativity.

Andrei Semenov

Andrei graduated from the University of Colorado, Boulder in 2013 with a B.A. in Psychology and Philosophy where he studied the relation between children's daily schedule and their executive function. He is most interested in how children use play, mindfulness, & neurocognitive skills such as executive function to solve problems.

Annelise Pesch
Annelise graduated from Arizona State University in 2014 with a B.S. in psychology and a B.A. in philosophy. She is interested in social-cognitive development, including theory of mind, social learning, and executive function in early childhood.

Jessica Faber

Jessica graduated from Rice University with a B.A. in Psychology. She then worked at Baylor College of Medicine for two years in neuroimaging research (structural MRI and pediatric mTBI). She attended and presented at the annual International Neuropsychological Society on DTI and TBI. Her research interests included neuropsychology, executive functioning, and academic achievement.

DID YOU KNOW?

Executive Function continues to develop throughout adolescence and doesn't reach maturity until age 25!

Father Parenting and Preschool Executive Function

By Alyssa Meuwissen

Research has established that the ways in which mothers interact with their children can play a role in children's development of executive function. However, very little is known about how father parenting supports executive function, so I began to study how fathers interact with their preschool children.

About two years ago, a group of 3-year-olds came to the lab with their dads. The children completed a number of tasks measuring executive function – for example, following complex directions and using self-control. The fathers and children also completed a puzzle task together. From this first round of the study, we learned that fathers who were more "autonomy supportive" (supported the child's independence and gave the child more responsibility for the task) during the puzzle had children who were more able to control their own behavior on the executive function tasks.

This past year, these children again came to the lab with their dads, when they were about 5 years old. The children completed similar executive function tasks, and we examined father parenting through another puzzle task and also in a gym play context to measure physical play. We had 91 father-child pairs complete both sessions. Longitudinal studies are very important to see if we can predict outcomes across time rather than just examine how two things are related concurrently. Data from this study are still being analyzed. Early results indicate that fathers' support of their children's autonomy during the puzzle at 3-years-old predicts better performance on a composite of school readiness skills at age 5 (including early reading, math, and executive function measures). Because one main difference that is found between mothers and fathers is how they play with their children, I also examined how fathers interact with their children in a physical play context. I found children with lower executive function at age 3 were more likely to have fathers who dysregulate their children during play (by pushing ideas that are scary or overwhelming to the child) during the gym play at age 5. Together these results indicate that father parenting influences children's cognitive development over the preschool years, and children's executive function also influences fathers' parenting behavior.

Overall, this work is finding that father parenting is an important influence on child EF development in the preschool years, and that it is important to include fathers in studies to get a full picture of parenting.

Understanding the Link between Brain Development & Executive Function

By Sammy Perone, Ph.D.

Children's executive function abilities improve rapidly between 3 and 5 years of age. Executive function helps children think in new ways, keep more information in mind, and control their behavior in a purposeful way. Not surprisingly, these abilities are quite important for children as they begin school, helping them pay attention, learn, and interact with their teachers and peers.

Little is known about how children's improving executive function abilities are influenced by their developing brain. One reason for this is that, to date, there has not been a good method for studying brain development during the preschool years. Our study is overcoming this barrier to study how children's developing brain is linked to their developing executive function abilities between 3 and 5 years of age.

Our study uses electroencephalography (EEG), which is a non-invasive brain imaging technique. This technique utilizes a net with tiny, soft sponges that is placed on the child's head. The sponges contain electrodes that record the electrical activity produced by the brain while children are thinking and paying attention.

To explore how children's executive function abilities are linked to their brain activity, we assess children's executive function abilities with a version of the Minnesota Executive Function Scale (MEFS™-Neuro). The MEFS™ asks children to use a rule to sort cards. Rule use is a key feature of executive function, and rule use is highly relevant in the classroom. For example, children have to remember the rule that story time is a time to sit still and listen. As the levels of the MEFS™ increase, the sorting rules become increasingly complex. For example, a simple rule might ask children to sort cards with blue circles on them by their shape. As children get older, they can use more complex rules.

The study results are showing that the brain's

activity is becoming more efficient as children get older. This efficiency is associated with children's ability to use increasingly more complex rules in the MEFS™ task, too. This finding suggests that some aspects of executive function, such as rule use, stem from the increasing efficiency with which the brain processes information. This study is ongoing so stay tuned for an update on the results!

Executive Function and the Achievement Gap

A Dissertation by Erin Schubert, Ph.D.

A participant takes time to reflect before choosing where to correctly place a card in the Dimensional Change Card Sorting (DCCS) task.

The achievement gap between children of different socioeconomic status (SES) is a grand challenge for developmental psychologists. Fortunately, not all low SES children develop adverse outcomes. Research has identified executive function (EF) as an important characteristic of resilience. EF can be improved through a diverse array of training programs. Yet, these programs do not improve the EF of all participants. An understanding of which individuals benefit from EF training is essential to wide scale dissemination of empirically validated interventions. The objective of this research was to determine the characteristics of children who are most likely to benefit from EF training.

Participating families (N = 134) were recruited from group childcare centers, representing a broad range of SES. Children were randomly assigned to a control or intervention group. Parents provided information on children's demographic and socioeconomic characteristics. All children participated in individual pre- and post- sessions during which their EF and IQ were assessed with direct behavioral measures. Experimenters completed a report on child EF after each session. Between assessment sessions, children in the intervention group received two 10-15 minute sessions of EF reflection training. Children in the control group participated in two 10-15 minute sessions in which they practiced EF tasks but were not given training or feedback. Children in the intervention group as a whole demonstrated marginally significantly better EF performance at post-test than children in the control group. Regardless of children's starting level on EF, children from lower SES families showed significantly more improvement following the intervention than children from families with higher SES.

Psychological Distance: Competence and Frustration

By Amanda Grenell

Competence:

Building off of our past research on the effectiveness of a distanced perspective on children's self-regulation, we are examining reasons why pretending to be an exemplar character such as Batman seems to be an effective strategy for improving young children's self-control. In particular, we wondered if the characteristics of the media character such as his or her competency were important for the distancing strategy to be effective. Therefore, we invited 96 5-year-olds and their families to visit our lab for a study to begin to better understand this particular strategy for improving young children's self-control.

For this study, children were instructed to either pretend to be a competent or incompetent character while working on a self-control task. We created characters that were either competent or incompetent and had children watch brief videos of the characters that highlighted either their competency or incompetency in four different domains: intelligence, physical strength, physical speed, and obedience. After children watched the video, they were introduced to the Minnesota Executive Function Scale (MEFS™) which is an iPad game where they had to sort cards based on different rules. This game measures their executive function since they have to remember rules, flexibly switch between rules, and inhibit using an old rule to use a new rule. After practicing the game, children were told that the game can be hard and that some kids find it helpful to pretend to be somebody else while they are playing the game. Then they were told to pretend to be the character they just saw in the video and were given a prop (e.g., a bib or a cape) to help them get into character. Throughout the game, children were reminded to think about where the character should put the cards. Our initial findings are that children who were pretending to be the incompetent character had lower scores on the iPad game than children who were told to pretend to be a competent character. However, it seems that competency of the character might not be the only characteristic that is important for this strategy to be effective, so we are planning a follow-up study in the fall to examine how familiarity with the character influences the effectiveness of pretending to be someone else.

A participant pretends to be a super hero while playing the Minnesota Executive Function Scale (MEFS™).

A participant feeling frustrated when he cannot find the right key to open the toy box.

Frustration:

Preschoolers and early school-aged children are often faced with the challenge of regulating and controlling their thoughts, actions, and feelings. In particular, learning to control and regulate one's emotions is especially hard for children of this age. Therefore, it is important to figure out ways to help children learn to better regulate their emotions. One strategy that we have used in past studies is *psychological distancing* or creating mental distance between the child and a difficult problem or situation. We have found that psychological distancing can be a useful strategy for helping children persist longer on boring tasks and perform better on a self-control task. Therefore, we wanted to explore whether this same strategy would also be useful for children when they are faced with an emotionally frustrating situation.

For the frustrating task, 4- and 6-year-olds locked an attractive toy (e.g., doll or remote control car) in a transparent box. Children were told they could only play with the toy if they could find the right key to open the box. Before the researcher left the room, children were told the task could get frustrating, and that kids find it helpful to think about their feelings when they get frustrated. Specifically, children were told to think about their feelings using the first person, their own name, or a media character's name such as Batman. Children who were pretending to be media characters wore a prop (e.g., cape) to help them pretend to be the character. Children were then given a set of keys and the researcher said she would be back in a little bit. The researcher left for ten minutes or until children signaled they were done with the task by placing the keys on a table. The keys given to the children were different than the set used to lock the toy in the box such that none of the keys worked to open the box.

Overall, we found that the psychological distancing strategy helped 4-year-olds with their emotion regulation during the frustrating task such that they were less frustrated when pretending to be an exemplar character like Batman than when they were using the first person while thinking about their feelings. We also found that children with low executive function or self-control benefitted more from the distancing strategy than children with high executive function. We plan to look at cognitive skills and behaviors that might predict individual differences in the effectiveness of the psychological distancing strategy to learn more about who might profit most from using this strategy.

Mindfulness + Reflection Training Improves Executive Function

By Philip David Zelazo, Jessica Forston, Ann S. Masten, and Stephanie M. Carlson

Executive function (EF) skills are essential for academic achievement, and interventions targeting EF prior to the transition to school may have cascading effects including improved achievement. In this study, we assessed the efficacy combined mindfulness activities and reflection training on a child's EF, theory of mind, and literacy. The 4- to 5-year old participants were enrolled in two US schools: one in Houston, TX and the other in Washington DC.

We expected that the combination of mindfulness and reflection training would provide a powerful intervention well suited to this population. Whereas mindfulness training should help children calm down, regulate stress, become aware of moment-to-moment experience, and sustain attention, reflection training should help children recognize when they need to go off "auto pilot" and instead act deliberately, reflecting on the situation and exercising their EF skills. The combined intervention included 30 lessons (24 min each) delivered in school daily over 6 weeks by teachers who received a full day of training to administer activities in the 14-lesson mindfulness curriculum plus three EF-challenging games that were repeated multiple times across lessons. Each game had 6 levels of EF challenge. Four teachers (2 in each city) were recruited and trained in one of the two active conditions. Each taught 4 classes of 8-12 students each per day.

Children were randomly assigned to Mindfulness + Reflection, Literacy, or Business as Usual conditions. All groups showed improvements in EF over the course of the intervention, but planned contrasts showed that the Mindfulness + Reflection group significantly outperformed the business as usual group at Follow-up. Literacy did not differ from the business as usual group at any time point. Children at the Houston site showed larger improvements in EF than children at the DC site. Children also improved significantly over time on theory of mind and emergent literacy, but this did not vary by condition. Overall, results suggest that a brief small-group school-based intervention that teaches mindfulness and reflection is promising for improving EF skills in pre-school age, low-income children.

Example screenshot of the MEFS™.

Measuring what Matters with Reflection Sciences

Our lab Directors are also Co-founders Reflection Sciences, a University of Minnesota start-up company that provides professional development about EF for educators and the Minnesota Executive Function Scale (MEFS™), a brief tablet game that validly and reliably measures EF skills in children from age 2 years and up. The MEFS™ has been used over 10,000 times by over 50 clients and counting. Users include researchers, PreK-12 schools, clinics, non-profits serving at-risk children and families, and public and private early childhood education providers. Dr. Carlson is currently serving as CEO and Dr. Zelazo is the Chair of the Advisory Group. We are very excited about our ability to rapidly learn so much more about EF development through widespread use of the MEFS, while having a positive impact on organizations that want to "measure what matters" when it comes to preparing young children for success.

New Publications!

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Zelazo, P. D., Blair, C. B., & Willoughby, M. T. (2016). *Executive function: Implications for education*. Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education. Available at http://ies.ed.gov/.

Selected Presentations

Carlson, S. M. (2016, October). Invited keynote speaker at the *Early Learning Community Lecture Series*, Marsico Institute for Early Learning and Literacy, University of Denver.

Zelazo, P. D. (2016, September). *Executive Function Skills: Foundation for Learning and Adaptation*. Invited Lecture, Pennsylvania Departments of Human Services and Education, Philadelphia, PA.

Zelazo, P. D. (2016, July). *Reflection Training: Executive Function and the Developing Brain.* Invited Opening Plenary, International Society for the Study of Behavioural Development (ISSBD), Vilnius, Lithuania.

Zelazo, P. D. (2016, May). *Executive Function: Foundation for Learning.* Invited Plenary Lecture, Göteborg AMBLE International Symposium on Reading, Mathematics and the Developing Brain, Göteborg, Sweden.

Carlson, S. M. (2015, November). Executive function: The "X" factor in early learning. Invited presentation in *Research Panel on Executive Function*, National Association for the Education of Young Children Annual Meeting, Orlando, FL.

Carlson, S. M. (2015, May). *Executive function and psychological distance*. Invited workshop for teachers, Zhejiang Normal University, Hangzhou, China.

The U of M is driven to tackle the opportunity gap

"Giving children even a small boost in these crucial executive function skills prior to the transition to kindergarten can help put children on a different kind of developmental trajectory, one that's headed toward success as opposed to failure."

Philip Zelazo, Ph.D.

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About Us

The Developmental Social Cognitive Neuroscience Lab is located at the University of Minnesota Twin Cities campus, and is under the direction of Dr. Stephanie M. Carlson and Dr. Philip David Zelazo. Our research examines many aspects of cognitive and social development across the lifespan, but focuses on executive function (related to self-control).

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