

What's Going on in This (Developmental) Classroom?

DERS Working Paper #1¹

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June 30, 2017

Introduction: Why Another Environment Rating Scale?

The Developmental Environmental Rating Scale (DERS) is a classroom observation tool that measures the quality of learning environments serving children between the ages of 2.5 and 12.² The fundamental purpose of the DERS is to provide a detailed and multidimensional view of what actually goes on inside classrooms, particularly classrooms directed toward supporting optimal human development. The tool aligns environmental design and implementation with desired outcomes related to executive function, linguistic and cultural fluency, and social-emotional learning. It is intended for use by teachers, educational leaders and researchers for both formative and summative assessment.

Developed over the course of four years of classroom-based research combined with comprehensive reviews of the literature on cognition and pedagogy, the instrument evolved from a simple checklist designed to indicate the presence of selected items to an elaborated sequence of scales indicating item magnitude and frequency, as well as presence. The 60 items comprising the DERS are organized across three observational categories—children, adults, and the environment—and scored using an iPad app during a one-hour classroom observation. At the conclusion of an observation, the app generates (1) a narrative report, (2) a numerical rating, and (3) a graphic display of all 60 rated items. Use of the DERS requires training and certification directed toward achieving inter-rater reliability.

The DERS was released as an iPad app in January 2017, and is currently in the pilot phase of use. To date, thirty-five schools have received training and are engaged in the process of certification. These schools, which are members of a network of early adopters, are using the instrument alongside the

¹ NCMPS is grateful to the following individuals who provided valuable feedback on this analysis: Stephanie Carlson, Susan Engel, Steven Hughes, Angeline Stoll Lillard, Elizabeth Pungello, and Laura Flores Shaw.

² Currently two instruments are available: one for early childhood environments (ages 3-6) and another for elementary environments (ages 6-12). The framework and structure for both instruments are the same, though (how many?) items DERS for elementary environments are adjusted to reflect the developmental characteristics and needs of children between the ages of 6 and 12. This discussion concentrates on the Early Childhood version of the instrument.

Minnesota Executive Function Scale (Carlson & Zelazo, 2014) as part of the process of investigating the DERS' capacity to predict student performance of measures of EFs. The DERS does not measure these child-level outcomes directly. Rather, it reflects the manner in which the classroom environment promotes the development of these outcomes for children.

While other instruments exist to measure classroom quality (Denny, Hallam, & Homer, 2012; Hegseth, 2017; Sylva, et al, 2006), the DERS is unique in three ways. First, the DERS is explicitly framed by the theory and practice of developmental learning. In laying out key precepts that frame our definition of quality, the assumptions that govern the instrument are transparent, coherent, and grounded in research. Second, the DERS offers an unusual degree of specificity with regard to classroom attributes that support human development. The instrument is designed to capture the details of practice through a focus on concrete and observable phenomena. Finally, the DERS intentionally aligns attributes that characterize the inputs of developmental education with desired outcomes such as curiosity, empathy, persistence, reason, and self-regulation. Grounded in research on cognition and pedagogy, the DERS honors the complexity of student-centered, developmental learning environments while highlighting key environmental characteristics as they relate to wide-scope, developmental outcomes.

What follows is a discussion of how we arrived at each of these elements and how we combined them to create a comprehensive, descriptive, and adaptable classroom assessment instrument. Mirroring the process of the tool's development, we begin with explicating the importance of wide-scope developmental outcomes and demonstrating how we mapped backward from those outcomes to arrive at the 60 items comprising the instrument. Next, we situate the DERS within the theoretical framework of developmental education. Finally, drawing from both that theoretical base and recent research on ambitious teaching and learning, we propose a definition of classroom quality, which is operationalized in the 60 items comprising the DERS.

Linking Outcomes to Inputs

The 60 items comprising the DERS are clustered around three broad aspects of human development: 1) executive functions, 2) linguistic and cultural fluency, and 3) social/emotional learning. Executive function is delineated into its three common factors (Miyake et al., 2005), creating five outcome domains illustrated in figure 1:

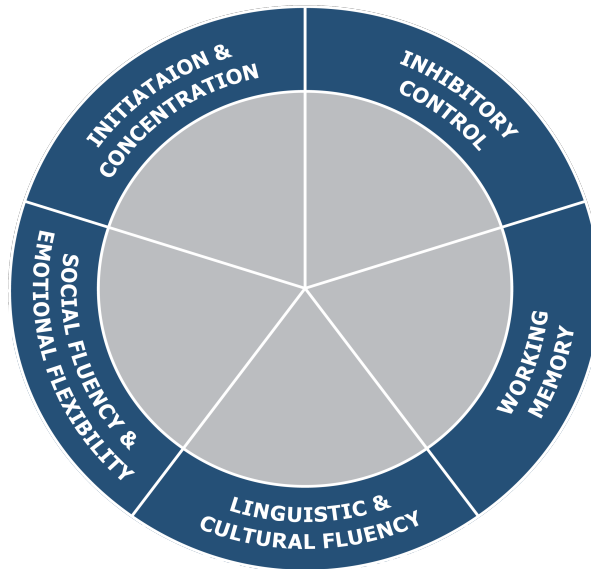


Figure 1: DERS Outcome Domains

The first three domains (Initiation and Concentration, Inhibitory Control, Working Memory) function as a cluster of capacities associated with executive functions, which, together, have been associated with critical cognitive and social outcomes as well as general life success (Blair & Razza, 2007; Mischel, Shoda, & Peake, 1990; Moffitt et al, 2011). The fourth domain, Linguistic and Cultural Fluency, is built upon a research base that situates language development within cultural context (Bruner, 1985; Turner, 2008; Vygotsy, 1978; Wertsh & Tulviste, 1990). Similarly, cultural and linguistic competence are strongly linked to emotion. That is, meaningful communication is emotive as well as cognitive. It is catalyzed by the desire for connection, and enabled by sensitivity and responsiveness. In targeting fluency—as opposed to utterance or phonemic awareness—as the operative skill, and by explicitly linking linguistic and cultural competence, we aim to offer a nuanced view of the “language-rich” classroom. Similarly, the fifth domain, Social Fluency and Emotional Flexibility links capacities such as the ability to recognize social cues with emotion regulation, self-efficacy, and resilience (Baumrind, 1989; Eisenberg, et al., 2011; Ivcevic & Brackett, 2014).

All five DERS domains have distinct as well as overlapping characteristics. Executive functions (EFs), for instance, which are often described as “the air traffic controller” of the brain” (Center on the Developing Child at Harvard University, 2011), include such capacities as attention, inhibition, shift, and working memory. EFs enable us to control our actions, intentions, and emotions; EFs influence how we navigate challenges and solve problems (Carlson, Zelazo, & Faja, 2013). It is not surprising, therefore, that EFs correlate with academic, social, and emotional outcomes. Working memory—or the ability to hold information in mind while using it—is key to, among other things, learning to read and performing

mathematical calculations (Brady & Shankweiler, 1991; Craig & Gilmore, 2014; Jordan & Baker, 2011; Locascio, et al, 2010). Likewise, impulse control and cognitive flexibility are necessary for both competent social interaction and emotional regulation (Kutsyuruba, Klinger, & Hussain, 2015; Sugden, et al, 2006). EFs, in other words, play an overarching and, at times, integrative role, in healthy human development (Diamond, 2000, 2013). The DERS is designed, explicitly, to reflect the holistic manner in which development occurs.

New research on the importance of EFs together with what are sometimes called “soft skills” has triggered an uptick in efforts to describe and measure EFs in school and beyond (Blair, Zelazo, & Greenberg, 2005; Heckman & Kautz, 2012). The DERS is part of that trend in that it prompts practitioners, parents, and policymakers to measure what matters most for human flourishing. It aims to move EFs to the center of considerations of classroom quality in ways that are concrete, detailed, and subject to reflection and improvement.

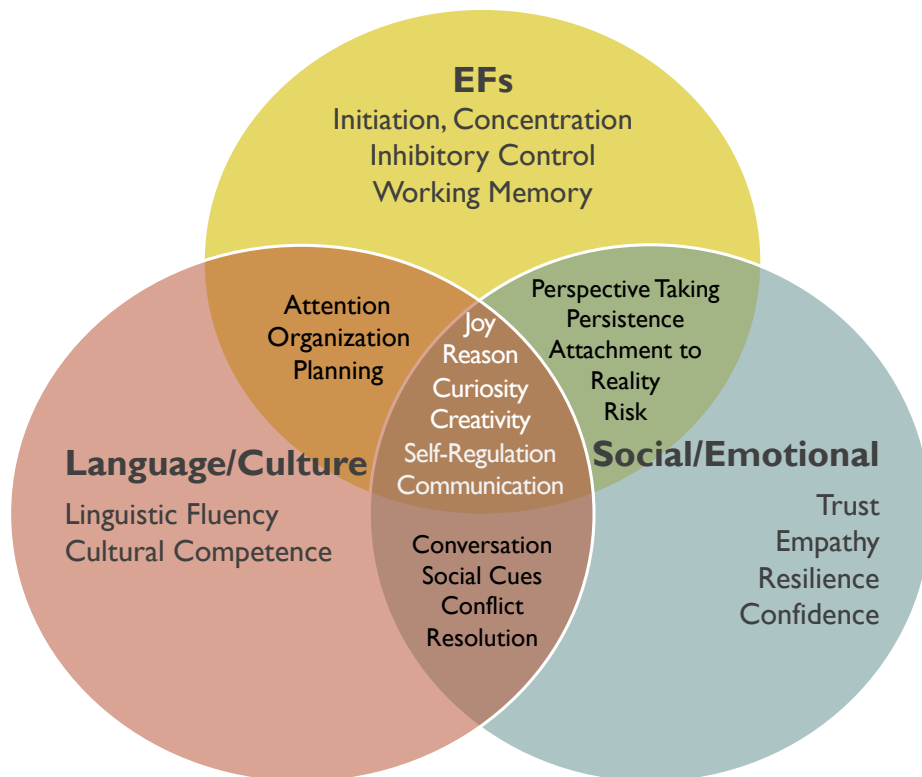


Figure 2: Wide-Scope Developmental Outcomes

Figure 2 illustrates how key aspects of human development—those addressed by the DERS—interact and, often, overlap. We identify these dimensions as “wide-scope developmental outcomes” because

they represent an expansive vision of the consequences of education, one that includes but extends well beyond what typically falls under the umbrella of “student achievement.”

Consistent with an expanding literature that argues for re-framing what meaningful learning entails and how schools should organize themselves to achieve such learning (Engel, 2015; Galinsky, 2010; Golinkoff & Hirsh-Pasek, 2016; Heckman & Kautz, 2012), the DERS is grounded in a transparent set of propositions related to what constitutes outcomes that matter. Additionally, while the DERS does not assess those outcomes, it does assume that they are describable and measurable as discrete sets of skills and understandings. Perhaps most important, the DERS assumes that those same skills and understandings are inextricably connected.

It follows, therefore, that the types of learning environments most likely to nurture developmental outcomes would be designed to address human development both explicitly and holistically. That is, we should be able to trace a direct link between what happens inside developmental classrooms and what children can do/know/understand as a result. Mapping backward from outcomes that matter most to human flourishing, the DERS aligns inputs and outcomes of developmental education.

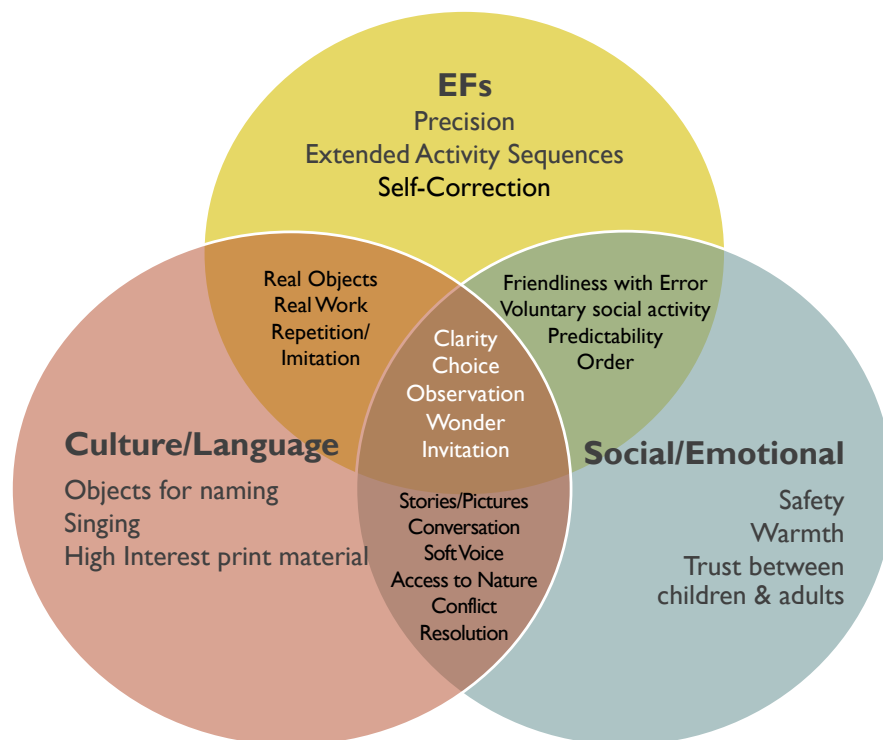


Figure 2: Mapping Inputs and Outcomes

Figure 3, above, illustrates the way items (inputs) such as precision, objects for naming, and warmth map onto the outcome domains addressed by the DERS. Consistent with the way domains overlap, figure 3 also illustrates the way inputs such as friendliness with error, repetition, and conversation support learning in multiple domains.

The integrated manner in which inputs affect outcomes suggests that educational programs aimed toward achieving wide-scope developmental outcomes should be devoted primarily, if not exclusively, to cultivating the skills and understandings necessary to realize those outcomes. Within this frame, isolated interventions designed to boost EFs or creativity or persistence are not likely to succeed—not because such strategies are inherently without merit, but because development is a holistic enterprise. Achieving wide-scope outcomes calls for a wide-scope educational approach.

We define developmental classrooms as learning environments that, by design, conform to key precepts of physical, cognitive, social, and emotional development. Those precepts, which are both widely accepted by practitioners and robustly supported by research on how humans learn, include:

- **Human development is an integrated process**, in which physical, cognitive, social, and emotional growth are linked and, often, codependent. Cognitive development, for instance, is inseparable from motor development (Diamond, 2000).
- **Human development is a gradual, continuous, and cumulative process**, based on patterns of neurological development that are hierarchical and somewhat predictable. The process begins at birth, with the formation of locally organized cognitive structures that, with maturation, establish distributed functional networks. Human development is protracted, continuing through one's early twenties.
- **Human development is an active process**, the majority of which occurs organically through self-directed interactions with people, objects, and concepts. Humans are biologically driven to explore, and we construct understanding through experimental experiences with our environment, including peers, adults, and the attributes of the physical space itself.

- **The quality of the environment within which learners interact can either foster or impede healthy development.** Environments that nurture optimal development are enriched, orderly, predictable, peaceful, allow for guided choice, free movement, voluntary social activity, and extended opportunities for trial and error correction.

Thus, the descriptor “developmental” is meant to both capture these precepts and point toward characteristics of environments most likely to foster optimal learning. A more detailed treatment of our definition of “quality” follows.

Defining Classroom Quality: The Developmental Core

What kind of environment is most likely to foster executive functions, linguistic and cultural fluency and social fluency and emotional flexibility? This is the primary question addressed by the DERS. As described above, the DERS is driven by a set of research-based precepts related to the process of human development. Those precepts—that development is integrated, cumulative, driven by exploration and self-construction, and influenced by the nature of the environment within which the learner operates—frame our definition of classroom quality, which is operationalized in the sixty discrete items comprising the DERS.

Guided by these precepts, the instrument starts with the assumption that learning takes place among a dynamic set of interactions between child, adult, and environment. This distinctive view of learning, what is sometimes referred to as the “instructional core” (Elmore et al. 2009; 1995), re-frames the process of instruction to de-emphasize both teacher-centered content transmission and dyadic interactions between teachers and students (Hamre, et al, 2013). Rather, within this frame, the child moves to the center of a triadic enterprise, constructing—as opposed to receiving—understanding through structured, spontaneous interactions with both adults and the environment (Cossentino, 2005; Whitescarver & Cossentino, 2007). Within this framework, the defining features of quality instruction shift away from teacher moves like questioning, dialog, monitoring, and feedback, and toward observing, inviting, and protecting not just engagement, but a child’s opportunity to engage in motivated problem-solving experiences, and to undertake concentrated investigations necessary for such experiences.

To signal this shift away from teacher-centered content delivery and toward a holistic conception of developmental learning, we refer to the child-adult-environment triad illustrated in Figure 3 as **The**

Developmental Core. This term also signals the instrument’s most immediate inspiration: Montessori education.

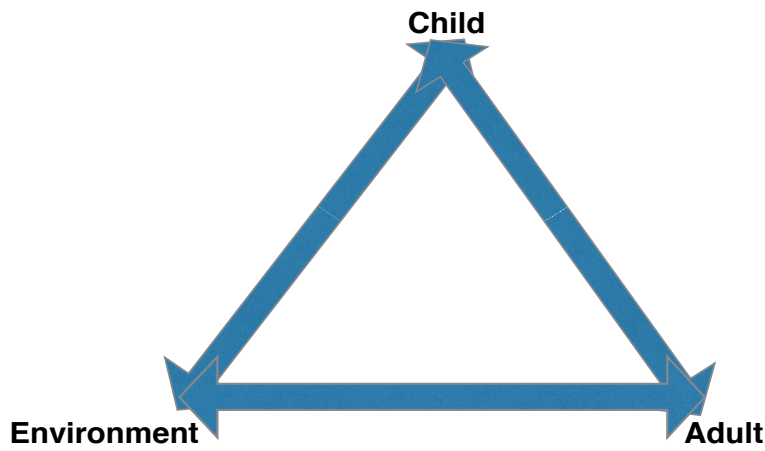


Figure 3: The Developmental Core

Long before the image of practice as a triangle of interactions between students, teachers, and content was articulated by scholars such as Ted Sizer (1984), Deborah Ball (Ball & Forzani, 2009, 2011), Magdalene Lampert (2001), and Richard Elmore (2009), Maria Montessori (2000/1949, p. 7) described supported development as “a natural process which develops spontaneously in the human being. It is not acquired by listening to words, but in virtue of experiences in which the child acts on his environment. The teacher’s task is not to talk, but to prepare and arrange a series of motives for cultural activity in a special environment made for the child.”

Montessori went on to elaborate precisely how adults and children interact with both one another and the environment in ways that help make the conceptual framework of developmental learning remarkably concrete. Adults engage with the environment by *preparing* it for children’s use. They engage with children by *inviting*—as opposed to commanding—them to interact directly with the materials that comprise the prepared environment. Invitations are based on adults’ careful *observation* of the child’s current developmental status and their history of engagement with other materials in the environment. Children, in turn, accept invitations for lessons, and spend most their energy and time focused on *working* with the materials and interacting with their peers as they construct their own competencies. This activity takes place within a physical space designed explicitly to meet the needs of children during particular developmental periods (e.g., early childhood, the elementary years, and adolescence).

Over the course of more than a century of experimentation and refinement, the principles of Montessori education have been elaborated into a highly detailed and coherent pedagogical system (Cossentino, 2005, 2006, 2009, 2017). Many of the details characteristic of the Montessori system have found their way into general standards of developmental learning. Child-sized furniture and implements, for instance, originated in Montessori classrooms. Likewise, hands-on materials for children to choose, manipulate and explore are features of most early childhood classrooms, as is the notion that peer-to-peer as well as child-to-adult interactions should be both positive and plentiful. What is less commonly present outside the Montessori system is a comprehensive treatment of key micro-moves that can, at first glance, seem incidental but are, in fact, critical to the system's coherence. For instance, the idea that live plants should be part of a well-prepared environment might appear to be little more than a nod to décor. However, in addition to contributing to a nature-inspired classroom aesthetic, caring for live plants provides children the opportunity to practice concentration and small motor coordination, and supports the development of working memory through the mastering of multi-step sequences entailed in the activity. In classrooms that use those same plants in botany study, opportunities for vocabulary development and concept exploration are also present. Finally, when plant (as well as animal) care is woven into the cultural fabric of the classroom, the activity offers children the opportunity to develop the social and emotional skills of compassion and service.

As cognitive psychologist Angeline Stoll Lillard demonstrated in her (2017) analysis of Montessori pedagogical principles, the core precepts of developmental learning are both backed by a vast and expanding research base and made vivid in the practice of Montessori education. Lillard examined nine principles that are both embodied in Montessori pedagogy and supported by a robust literature base on human cognition. Those principles—movement, choice, executive function, interest, motivation, learning from peers, meaningful contexts, adult interaction styles, and order—together with specific moves that are visible in a variety of developmental classrooms (including, but not limited to Montessori), informed the design of the DERS.

That is, where Lillard demonstrates how current research on cognitive development validates core principles of Montessori theory and practice, which are consistent with the core precepts of developmental learning, the DERS aims to identify, in precise detail, what actually goes on in classrooms that embody those precepts. As a result, the instrument is populated with highly specific items, which are further elaborated in scaled indicators designed to capture the magnitude as well as frequency of attributes known to be associated with optimal development.

To achieve this specificity, the DERS was developed, in part, through consultation with Montessori experts and initially tested in Montessori classrooms. The design process was iterative, involving multiple observational trials using a paper-pencil version of the instrument. Items and indicators were reviewed for accuracy and saliency. Classroom trials revealed that certain items were not necessarily visible within a 60-minute window for observation, while others proved to be visible, but not clearly linked to any of the five outcome domains. Paper-pencil trials also revealed difficulties related to the size of the instrument. Addressing 60 discrete items and their attending indicators proved challenging for observers. Some advisors suggested we reduce the number of items, and doing so might have produced a more efficient instrument.

The goal of the DERS, however, is not efficiency. Rather, its primary purpose is to provide a comprehensive, detailed, and usable portrait of what is actually going on in the classroom. Both size and nuance, therefore, are important features of the instrument. Ensuring that salient items are observed and recorded in the span of a sixty-minute observation session required us to build in a degree of redundancy, including mirror items that are negatively scored. At that point, we concluded that digitizing the instrument in a format that would allow observers to prioritize items while recording and revising scores in real time would enable us to retain both the breadth and depth of the tool. The current version of the DERS app employs a graphic touch-screen display of each item, organized according to the three observational categories (child, adult, environment). Users toggle among the three categories and assign a score by tapping on the item name and selecting from the indicators that appear. Scores may be revised throughout the observation, at the conclusion of which users are prompted to review their scores and confirm completion.

We also aimed to capture the integrated nature of learning in developmental classrooms. We achieved this goal by orienting the scoring algorithm toward outcome rather than input domains. That is, the DERS addresses both the extent to and the way in which classrooms foster EFs, Linguistic and Cultural Fluency, and Social Fluency and Emotional Flexibility. While not a measure of these capacities themselves, the tool highlights the link between what goes on in learning environments and the results of that activity. Again, the iPad app enabled this goal by allowing us to develop an algorithm linking each item to one or more of the outcome domains. Consistent with the precepts of developmental learning and the framework of the Developmental Core, most of the DERS items map onto multiple outcome domains.

Such overlap suggests that the DERS will not demonstrate factorial purity within individual domain scores. Indeed, scores in one domain tend to correlate with those of the other four domains. Reporting

features three levels of analysis: numerical, narrative, and graphic, allowing users to tack back and forth between a synthetic view of the classroom as a developmental environment and a detailed view of specific moves captured at the item level.

To summarize, quality as defined by the DERS is grounded in research on outcomes that matter, and informed by the specificity and coherence of Montessori theory and practice. That specificity is reflected in the 60 items comprising the instrument. However, as Lillard and others have made clear, the principles that define quality as measured by the DERS extend well beyond the confines of Montessori classrooms (Diamond & Lee, 2011; Galinsky, 2010; Rathunde, 2014), and the current version of the instrument is meant to be used accordingly. In the next section we elaborate on our review of the research base of the DERS, and how that literature informed the instrument's design.

The Research Base

To arrive at an instrument designed to capture what goes on in developmental learning environments, we engaged in three distinct, but related, analytic activities involving the what, why, and how of optimal human development. First, we surveyed the literature on outcomes that matter most to human flourishing. Second, we considered that literature alongside a set of theoretical precepts defining what human development entails. Third, we articulated a definition of classroom quality that flows from both the theoretical precepts of human development and the outcomes literature. From there we derived a set of items and indicators that translated theoretical precepts into observable behaviors and attributes, and then linked those behaviors and attributes back to the literature on outcomes.

Honoring the integrated nature of learning in developmental classrooms, most observable qualities of classrooms that nurture executive functions, linguistic and cultural fluency, and social fluency emotional flexibility map onto multiple domains. For instance, environments featuring spontaneous turn taking support the development of both inhibition and social fluency. Likewise, uninterrupted learning time, free choice, voluntary physical movement, and adult behavior that is calm and respectful of student engagement are items that influence all five domains (Diamond, 2010; 2014a, 2014b; Lillard, 2007, 2012). Other items are prioritized to predict more specific domain-related outcomes. The sections that follow explicate the research base for each of the three core areas examined.

Executive Functions

Environments that foster the development of EFs have several features in common. First, they allow for free movement, choice, and opportunities for self-directed exploration, and trial and error-correction (Deci & Ryan, 2000; Deci, Koestner, & Ryan, 1999; Diamond, 2000, 2007, 2012; 2013; Diamond &

Lee, 2011; Dweck, 2006; Glenberg, Witt, & Metcalfe, 2013; Iyengar & Lepper, 1999, 2000; Renninger, & Wozniak, 1985; Tanner, 2008). Second, they are orderly and free of clutter. Visual stimulation, including access to television and computer screens, is intentionally curated, with attention to the quality as well as quantity of items in the space. This visual and spatial clarity enables attention, focus, and calm (Barrett, Davies, Zhang, & Barrett, 2015; Fisher, Godwin, & Seltman, 2014; Keupp, Behne, & Rakoczy, 2013; Pagani, Fitzpatrick, & Barnett, 2013; Wachs & Gruen, 1982).

Consistent with what has come to be known as the “Goldilocks effect” (Kidd, Paindatosi, & Aslin, 2012), children who are able to choose between a variety of activities (or “stimuli”, as Kidd and colleagues describe), reliably select to engage in information that is appropriately pitched to their developmental needs. As a result of engaging in “just right” activities—that is, neither too simple nor too complex—environments that offer lots of opportunity for choice, combined with uninterrupted engagement and friendliness with error are likely to be places where initiation, focus, repetition, persistence, and enjoyment are observed consistently among children (Alfieri et al, 2001; Blair & Razza, 2007; Diamond & Lee, 2011; Hidi & Renninger, 2006; Simon, 2001).

Adults in developmental environments are most often observed enabling exploration, engagement, and friendliness with error. That is, they encourage attention, persistence, and flexibility by inviting, rather than commanding, engagement, then by actively protecting that engagement through moves such as refraining from interruption, excessive error correction, or unnecessary direction (Diamond & Lee, 2011; Lillard, 2012; Ling, Wong, & Diamond, 2016; Raven, 1994; Whitescarver & Cossentino, 2007). At the same time, adults support the development of working memory through meticulous attention to the clarity of their speech, the precision of their movements and the general consistency and predictability of their behavior (Tomasello, 2003a, 2003b). As a result, children in developmental classrooms also demonstrate the capacity to re-focus their attention, inhibit behavior, and withhold gratification (Eisenberg, et al., 2004; Klein & Seligman, 1976; Lillard, 2012; Mischel, Shoda, & Rodriguez, 1989).

Items related to executive functions dominate the DERS, both in terms of direct alignment with domains 1 through 3, and in terms of overlap with the other two domains. In fact, the DERS scoring algorithm assigns 85% of all DERS items to EFs, with 60% of those items address three or more domains. The table below presents descriptive language linked to each DERS item that addresses EFs. This language appears in narrative reports generated by the DERS app, and represents language that would be generated for classroom scoring high in Domains 1 through 3.

Child Behavior	Adult Behavior	Environment Attributes
<ul style="list-style-type: none"> • Children begin activities without adult direction. • Children move freely around the environment and select work with minimal adult involvement • Children remain focused for extended periods of time, often choosing to repeat activities • Children express joy and satisfaction in the process of concentrated work. • Children walk around the room without stepping on or intruding on the workspace of others. • Children observe peers, and are able to refrain from touching others' work. • Children attempt multiple ways of correcting an error. • Children refocus and choose another activity/material when their first choice is unavailable. • Children engage in multi-step tasks and activities and have the opportunity to self-correct 	<ul style="list-style-type: none"> • Adults observe student activity, but do not interrupt when students are clearly concentrating. • Adults are responsive to child questions or requests with information and encourage independent problem solving. • Adults introduce new activities as an invitation rather than a command to learn and communicate wonder in their approach to children and content. • Adults permit children to discover the results of their actions rather than receive a warning about them. • Adults give clear verbal instructions for activities. • Adults offer children choices of different options. • Adults use descriptive language and avoid praise designed to flatter (e.g. "good job" or "you're so smart). • Adults' movements are unhurried, intentional, and predictable. • Adult-demonstrated motor sequences become progressively longer and more complex as children demonstrate mastery. 	<ul style="list-style-type: none"> • Materials and furnishings are child sized. • All areas of the environment are designed for children's use. • Materials are purposefully limited to allow students to make alternative work choices when work is in use. • Digital technology is largely absent from the environment, and not part of the method of curriculum delivery. • Materials and decor are organized according to learning domain and purpose. • Materials are selected for specific developmental appropriateness and functionality; there is nothing extraneous and no presence of commercial toys. • Decoration is strategic, with carefully curated visual stimulation. • The classroom provides lengthy periods of uninterrupted work.

Table 1: Descriptors pertinent to executive function

The dominance of executive function within the instrument reflects how EFs influence and predict performance in other important key areas. Several items reflected in the table above are repeated in Domains 4 and 5.

Linguistic and Cultural Fluency

Communication is a foundational capacity. Language is our principal cognitive tool, enabling us to both acquire and share knowledge, as well as to build and sustain relationships. As such, the ability to communicate through both oral and written language involves much more than phonemic awareness and vocabulary development. Rather, the development of language and thought go hand in hand. Language is also an emotional phenomenon, inspired by the desire for connection and enhanced by the doors to discovery it opens (Diamond, 2014a, 2014b; Dulay & Burt, 1977)

Linguistic fluency, in other words, is tied to cultural understanding (Frijters, Barron, & Brunello, M. 2000; Smith, 1966; Tomasello, 2003b, Tomasello & Ratner, 1993; Turner, 1995). We “read” situations, facial expressions, and cultural norms. Which means becoming fluent requires lots of opportunities to observe, experiment, and listen, as well as to name, interpret, and participate in conversation. Moreover, how we engage children in language is just as important as what we say to them. Learning environments that are truly “language rich” build from a foundation of order, calm, and beauty. They are filled with intentionally curated items for children to name, manipulate, and consider. Adults use language intentionally, speaking with and not at children, enunciating words with care, and, generally, focusing more on the quality rather than the quantity of spoken interaction (Kampmann & Browne, 2011).

The table below presents descriptive language generated by the DERS app for classrooms that score high in Domain 4: Linguistic and Cultural Fluency.

Child Behavior	Adult Behavior	Environment Attributes
<ul style="list-style-type: none"> • Children engage in frequent conversation. • Children sing—both spontaneously and as part of small or large group activity. • Children socialize in self-formed groups. • Children greet adults and peers with ease (indicators may include hand-shakes & eye contact). 	<ul style="list-style-type: none"> • Adults use language intentionally, with specific attention to vocabulary, clarity, modulation, pace, and tone. • Adults give clear verbal instructions for activities. • Adults speak with children using a conversational tone and manner, speaking with and not “at” children. • If a second language is part of the program, it is delivered via an immersion model, in which one adult speaks exclusively or almost exclusively in the second language. 	<ul style="list-style-type: none"> • The classroom contains many child-accessible? objects for naming • High-interest, age-appropriate print material is available at all times and on a range of topics that may be of interest to one or more children. • Room décor reflects cultural and ethnic backgrounds of the community of families. • Real objects, pictures, and books are used to introduce children to vocabulary, phonics, and syntax. • Materials are available for children to discriminate textures, and the majority are made of natural materials (wood, glass, metal, fabric). • Children have access to a range of functional, child-sized tools and implements (brooms, mops, shovels, flatware).

Table 2: Descriptors Pertinent to Linguistic & Cultural Fluency

63% of DERS items link to Linguistic and Cultural Fluency, with the majority of those items overlapping with EFs and Social fluency and Emotional Flexibility.

Social Fluency and Emotional Flexibility

Because communication is, foremost, a social activity, language and social development, which are both grounded in culture, are key partners. Likewise, EFs strongly correlate with emotional regulation and social competence (Cumberland-Li, Eisenberg, & Rieser, 2004). Social and emotional development

flourishes in environments that allow for spontaneous interaction among peers as well as between children and adults (Bailey, Burchinal, & McWilliam, 1993; Booren, Downer, & Vitiello, 2012; Grant, 1993). The mimetic nature of social development (Hogan & Tudge, 1999; Jackson, 1986; Tomasello, 2003a, 2003b) makes mixed age grouping and intentional adult modeling central to the process of both social and linguistic fluency—indeed, these processes are indivisible (Bruner, 1983; Gupta, 2008; Kuhl, 2007; Vygotsky, 1978). Environments that nurture emotional flexibility are safe places, signaled by an overall climate of tranquility and beauty (Armstrong & Detweiller-Bedell, 2008; Blair, 2010) as well as access to nature (Kellert, 2002; Taylor, Kuo, & Sullivan, 2001, 2002). Similar to the “goldilocks” principle of support for language and EF development, adult behavior supporting emotional flexibility is often characterized by a “just right” balance of warmth, connection and clear boundaries (De Woolf & van Ijzendoorn, 1997).

The table below includes language generated by the DERS app for classrooms scoring high in the domain of Social Fluency and Emotional Flexibility.

Child Behavior	Adult Behavior	Environment Attributes
<ul style="list-style-type: none"> • Children demonstrate care for their environment, including spontaneously dusting, washing, setting tables, pushing in chairs. • Children demonstrate care for their peers, including assisting with dressing, offering food, resolving conflicts. • Children use words to resolve conflicts with one another. • Children display an overt sense of comfort and trust in adults. • Children (over the age of four) clearly regard adults as a source of support and comfort, but direct most of their social attention to peers. • Children express joy and satisfaction in the process of concentrated work • Children refocus and choose another activity/material when their first choice is unavailable. 	<ul style="list-style-type: none"> • Adults model respect for the environment by participating directly in its care. • Adults make eye contact with children, bend to their level when speaking with them. • Adults share wonder and joy in student accomplishment and discoveries. • Adults use a soft, conversational voice at all times. • Adults introduce new activities as an invitation rather than a command to learn and communicate wonder in their approach to children and content. • Adults use descriptive language and avoid praise designed to flatter (e.g. “good job” or “you’re so smart”). 	<ul style="list-style-type: none"> • Children are grouped in mixed-age communities. • The physical space is organized according to aesthetic values of simplicity and order, garnering an overall sense of calm and harmony. • Room décor reflects cultural and ethnic backgrounds of the community of families. • Digital technology is largely absent from the environment, and not part of the method of curriculum delivery • Turn taking is embedded into activities such as sharing snack, using the restroom, selecting materials, implements (brooms, mops, shovels, flatware). • Children have ongoing access to nature.

Table 3: Descriptors Pertinent to Social Fluency & Emotional Flexibility

It is notable that none of the items represented above correlate exclusively to Domain 5. Rather, they all overlap with either the EF domains (1,2,3) or the Linguistic/Social domain (4).

Taken together, the three tables above illustrate the holistic way in which developmental learning environments operate. That is, environments that strongly support the development of EFs are likely to also support Linguistic and Cultural Fluency as well as Social Fluency and Emotional Flexibility. From this highly-detailed articulation of core elements, a portrait of a high-functioning developmental environment emerges. Developmental environments are places of both complexity and order, warmth and restraint, enrichment without over-stimulation, focused engagement as well as spontaneous social interaction. Adults are calm, precise in their movements, intentional in their language use, respectful of child engagement, and focused less on providing knowledge than on connecting children to activity within the environment. As a consequence, a good deal of adult activity is devoted to observing children in order to inform instructional decisions driven by children’s needs and interests. Children who learn in high functioning developmental environments often demonstrate many of the outcomes defined by the DERS. That is, they are highly engaged in independent activity, often showing persistence through repetition or extended attention to a single activity. They can be seen engaging in spontaneous conversation with peers as well as adults, shifting easily from group to individual activities, recovering from disappointment, and inhibiting impulses to touch, interrupt, or disrupt ongoing activity.

Validity and Reliability

The official design phase of the DERS occurred between October 2013 and June 2016. Between June and September 2016, the paper-pencil version of the instrument was converted to a tablet-based app., and between October 2016 and March 2017 the 120 users from 30 schools were trained. Since the official DERS iPad app was released in January 2017, 15 users have completed the certification process. As additional users become certified, score classrooms, and generate reports, we will have sufficient data to report on the validation process.

Content Validity

As described above, the DERS is designed to capture the complexity of developmental learning environments. It is not a measure of EFs, Linguistic and Cultural Fluency, or Social Fluency and Emotional Flexibility. Nor should it be used as a proxy for these capacities. Rather, the DERS is an assessment of classroom quality based on three factors. First is an explicit definition of quality grounded in precepts of developmental education, which are further elaborated in what we call The Developmental Core. Second is a conceptual and evidentiary grounding in scholarship related to cognitive, social, and emotional development, learning theory, and ambitious teaching. Third is an intentional alignment between the specific behaviors and attributes that encompass the inputs of Developmental education and a set of capacities that may be considered the outcomes of such an education. As the first instrument of its kind designed to measure classroom quality based on this particular definition of quality, we rely on the research base described above as expert consensus for the DERS' construct validity.

Predictive Validity

The DERS is not a measure of student competency in any of the five domains addressed by the instrument. Nor is it intended to be used a proxy for executive function, linguistic and cultural fluency or social fluency and emotional flexibility. Rather, the DERS is an observational tool designed to assess the likelihood that learning environments will nurture these competencies. As discussed above, all 60 DERS items are drawn from extensive research about adult behaviors, child behaviors, and environmental attributes that promote the development of EFs, linguistic and cultural fluency, and social fluency and emotional flexibility.

This research base suggests that performance on the DERS should predict performance on measures of these outcomes. Testing this hypothesis is central to our work during Phase 1 DERS rollout, which is currently underway. To do this, we have paired the DERS with the Minnesota Executive Function Scale (MEFS) (Carlson & Zelazo, 2014), a measure of EFs that is highly reliable, suitable for very young

children, and user-friendly. The MEFS is an iPad app based on the Dimensional Change Card Sort task, an established and respected measure of EFs that has been in use for decades, but expanded to include 7 levels of difficulty, spanning age 24 months and up. The MEFS has been shown to be reliable and valid. It was normed nationally on 7,410 typically developing children age 2-13 years, as well as a sample of 553 adults. It takes 5 minutes or less to complete. The MEFS has been given over 20,000 times, is being used in over 100 locations, in 8 countries, and is available in 7 languages (and an 8th under development). This instrument is sensitive to even short-term developmental and intervention-related changes in EF. We have bundled training for both tools together; schools that take the combined DERS/MEFS training are then eligible to join the DERS/MEFS Network, a community of practice for school-based continuous improvement using the DERS and MEFS.

Member schools also agree to share their DERS and MEFS data with NCMPS for the purposes of evaluating the predictive power of the DERS with regard to EFs. Classroom-level DERS scores in domains one through three will be correlated with student-level MEFS scores to determine the predictive validity of the DERS with regard to EFs. While the MEFS captures the outcomes articulated by the first three domains of the DERS, NCMPS is currently evaluating outcome measures that correspond to domains four and five. Predictive validity for these outcomes will be assessed after appropriate measures have been identified.

Inter-rater Reliability

The DERS was designed to for use by observers trained in the logic and language of both developmental learning and observation rubrics. As is the case with any observation-based instrument, achieving inter-rater reliability is a key component of the demonstrating the instrument's validity. Supports for this goal are embedded in the DERS training and certification process.

In training, users are introduced to the framework of the DERS and primed to observe features of the classroom environment, child behaviors, and adult behaviors. The DERS attributes, indicators, and scoring guides are reviewed on paper before introducing the iPad app. Participants then use the app to rate a sample classroom environment using both still and video footage, discussing items and indicators as they appear. The DERS trainer facilitates this discussion, supporting correct interpretation and application of the indicators and scoring guide. Users have the opportunity to ask questions, surface preconceived ideas, and resolve misconceptions and biases.

Immediately following the training, users are instructed to practice using the DERS in a live classroom before logging on to the DERS Network website to view and score a 20-minute video classroom video.

Those scores are reviewed by NCMPS staff members and variations among users are flagged. Users then attend a follow-up norming call, where problematic items are discussed and the certification video is revisited. A DERS trainer leads this call and guides discussion to support users' developing understanding of the items and scoring criteria. Users are then prompted to rate live classrooms in pairs. Scores from these live ratings are then compared to ensure that inter-rater reliability has increased to acceptable levels. As described above, approximately 105 users are currently moving through the multi-step certification process. Of those who have completed the process, all have achieved between 95% and 100% reliability. While these very early returns suggest that IRR is achievable, we reserve claims until a larger data set of users becomes available.

Research Involving DERS

Developmental Learning Environments and Creativity

The DERS is currently in use as part of an ongoing study of creative potential in public Montessori students. This work is part of a larger study of creativity in school settings in eleven different countries under the auspices of the Organization for Economic Cooperation and Development (OECD). Within this study, Montessori is considered one of many school-based interventions to promote the development of creative potential. For the purposes of this study, creative potential is defined as the capacity for both divergent thinking—or the ability to generate multiple solutions to a problem) and convergent thinking—or the ability to synthesize diverse stimuli into a coherent whole (Besançon, Lubart, & Barbot, 2013).

Creative potential is measured using a tool called the Evaluation of Creative Potential (EPoC), which assesses the capacity for divergent and convergent thinking within six different content areas. Research indicates that isolated interventions are insufficient to move the needle on creative potential; rather, nurturing creativity requires a holistic approach to interactions among students, teachers and content (Davies et al., 2012; Runco, 1993; West, 2002). We also know that creativity is strongly linked to EFs (Carlson & White, 2013; Diamond, 2014a; Diamond & Lee, 2011; Madore, Addis, & Schacter, 2015). Thus, this study examines the relationship among developmental learning environments, as measured by the DERS; executive function, as measured by the MEFS; and creative potential, as measured by the EPoC. The figure below depicts our theory of action for this study.

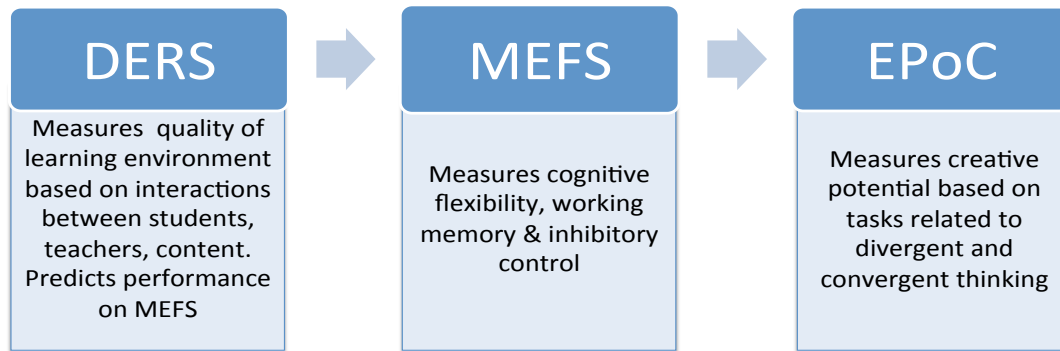


Figure 4: OECD Creativity Study

This design allows us to examine how variations in the quality of developmental learning environments are related to child outcomes with regard to EFs and creativity. Approximately 350 children enrolled in public Montessori programs at kindergarten and third grade are participating in the study. Results are anticipated in fall 2017.

Early Adopters' Experience

The DERS is currently in use in forty-schools in the US and Europe. These schools, the majority of which are using the DERS alongside outcome measures such as the MEFS, constitute the primary laboratory for studying the uses and impact of the instrument. Early adopters have reported that the DERS facilitates observation, reflective practice, and continuous improvement:

- “The DERS gives me a way to self-evaluate in advance of formal observations.”
- “It gives us a simple way of evaluating important quality factors for our classrooms.”
- “The DERS helps me to observe well and the scale helps me with specifics—things I may have overlooked before.”
- “With all the emphasis on academic skills via the CCSS, the DERS Training validated a more child centered and holistic approach promoting bigger picture ways of guiding children via the executive function emphasis that are fundamental to any skill building.”

Members of the DERS Network meet regularly via a monthly webinar, during which they share current practices, challenges, and suggestions for future versions of both the instrument and professional development experiences associated with observation, teacher evaluation, and school-wide continuous improvement systems.

Conclusion: Commencement

This paper represents the official launch of scholarly examination of the Developmental Environment Rating Scale (DERS). This introduction explicates the origin, conceptual grounding, and potential uses

of the instrument. As described above, the DERS is a response to the question: “what’s going on in this classroom?” By addressing, in fine detail, what actually goes on between adults, children, and the learning environment, the instrument aims to unlock what has been called “the black box of classroom practice” (Cuban, 2013). And in so doing, the DERS holds great potential as a tool for rigorous and transparent instructional reform. Early adopters cite the tool’s immediate utility as a support for classroom coaching and reflective practice. Others have suggested the tool’s potential as an alternative to existing classroom evaluation systems.

While early data are promising, they also raise questions we expect to address in much greater detail as users come on board and data resulting from that use become available. Specific areas we are attending to include:

The DERS in a Variety of Learning Environments

To date, the vast majority of classrooms in which the DERS has been tested are Montessori learning environments. Going forward, we aim to expand the reach of the tool to classrooms grounded in other models. Expanding the range of sites from which data is collected will also increase variability in scores, allowing us to better understand how variation in classroom environments is related to student outcomes.

The DERS as a Tool for Continuous Improvement

As described above, early adopters are enthusiastic about the DERS as a tool for classroom coaching and reflective practice. Members of the DERS Network are experimenting with a variety of methods for integrating DERS use into the culture of their respective schools. Examples include: collective scoring of selected classroom video footage as a means of calibrating shared language and logic related to school-wide expectations, video and score analysis as part of Lesson Study activities, and combining DERS with other input measures to develop a 360 teacher evaluation process. We look forward to learning more about how the DERS facilitates professional growth for classroom-level teachers and guides coherent evaluation of classroom practice.

The DERS as a Benchmark

The development of domain-level norms will help practitioners understand how their classrooms compare to those of other schools using the DERS. Likewise, as the DERS Network continues to explore alternative outcomes measures, we will be able to investigate and report on correlations between inputs and outputs as they relate to the details of classroom practice.

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