



# Overcoming the streetlight effect: Shining light on the foundations of learning and development in early childhood.

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### **Abstract**

Developmental theory has long emphasized a range of skills that young children need for healthy development across the life course. Nevertheless, most evaluations of early childhood programs and policies have focused on measuring a somewhat limited set of competencies. In this article, we explore this “streetlight effect” in early childhood intervention research and propose an initial set of skills that we argue are the foundations of learning and development (FOLD skills) and accordingly should be prioritized alongside traditionally measured outcomes as targets of intervention during the preschool period (i.e., between ages 3-5 years). These FOLD skills include both well-studied and emerging constructs such as curiosity, creativity, self-regulation and executive function, critical thinking, perspective taking, and internal representations of self. To better understand FOLD skills’ potential as more practical, effective, and inclusive targets of early childhood programs and policies, we review research regarding each skill’s malleability, measurability, predictive validity, and universality. We end with a set of future directions for the field, including the need to: (1) formulate a more inclusive taxonomy of FOLD skills that incorporates currently omitted competencies relevant to marginalized populations; (2) measure these skills in scalable and actionable ways; and (3) enhance or modify intervention strategies to optimize the development of these FOLD skills in the preschool period.

*Keywords:* child development; early childhood; intervention; measurement

**Public Significance Statement**

This article argues that existing approaches for evaluating the effectiveness of early childhood programs fail to capture important skills that serve as the foundations of learning and development across the life course. We find promising evidence to suggest that an initial set of these skills – including curiosity, creativity, self-regulation and executive function, critical thinking, perspective taking, and internal representations of self – could be malleable, measurable, predictive of other forms of learning and development, and relevant across diverse populations. We also present future directions for research to inform whether and how to prioritize these skills as targets in future early childhood programs and policies.

## **Overcoming the Streetlight Effect: Shining Light on the Foundations of Learning and Development in Early Childhood**

*A passerby sees a man searching for something under a streetlight and asks what he has lost. The man says he lost his keys and they both look under the streetlight together. After a few minutes the passerby asks the man if he is sure he lost his keys by the streetlight, and the man replies, no, he lost them across the street in the park. The passerby asks the man why he is searching here, and the man replies, “this is where the light is.”*

Over the past two decades, investments in services and policies for preschool-age children have exploded across the United States. Between 2000 and 2020, public spending on Head Start grew from \$5.3 to \$10.6 billion, while state pre-K investments expanded from a cumulative \$2.4 to \$10.4 billion over approximately the same period (Barnett et al., 2003; Friedman-Krauss et al., 2021; Head Start Early Childhood Learning & Knowledge Center, 2020). Research has been central in fomenting these investments, with evaluations dating to the 1960’s demonstrating positive short- and long-term effects of early intervention (e.g., Camilli et al., 2010; McCoy et al., 2017). Importantly, however, these evaluations have largely used academic assessments to judge intervention efficacy, raising questions about whether programs are optimally supporting the full range of skills, behaviors, and competencies that are increasingly necessary for success in our diverse and changing world (Deming, 2017).

The goal of the current review is to address this “streetlight effect” by shining light on evidence-based developmental skills that have largely been neglected as target outcomes of early childhood intervention evaluations. In doing so, we aim to provide a more expansive framework of options for evaluating early childhood programming that is better aligned with both the historical early childhood literature and the modern realities facing children in the 21st century. We begin this article with a brief overview of challenges and opportunities in early childhood intervention research. Drawing from existing frameworks in developmental science, we then

introduce a set of candidate skills that form the foundation of learning and development (herein referred to as “FOLD skills”). We review multidisciplinary research from the past seventy years to understand the extent to which these FOLD skills are (1) malleable, (2) measurable, (3) predictive of other important outcomes, and (4) universal in value and manifestation across a range of populations and settings. We end with conclusions and future directions for the field, including ideas for conceptual and empirical work that will help to refine and apply the framework presented here.

### **Challenges and Opportunities for Contemporary Early Childhood Intervention Research**

The mastery of key developmental tasks early in life has long been considered foundational to later well-being and success. Children’s acquisition of basic competencies during the early childhood period is thought to produce a series of developmental cascades, with early skills begetting later skills in the same and other domains (Cunha & Heckman, 2007; Masten & Cicchetti, 2010). Although genetic heterogeneity contributes to individual variation in these cascades, evidence indicates that early skills are also shaped by interactions among genes, environments, and timing that collectively impact subsequent development across the life course (Boyce et al., 2021; Bronfenbrenner & Ceci, 1994; Shonkoff & Phillips, 2000).

Responding to this scientific evidence regarding the predictive power and malleability of early-life skills, in the 1960’s and 1970’s several landmark studies – including evaluations of Head Start, the Abecedarian Early Intervention Project, the Perry Preschool Project, the Chicago Child Parent Center Program, and the Nurse Family Partnership – began to explore the developmental benefits of high-quality early childhood programming. These applied studies provided groundbreaking evidence regarding the potential of high-quality early intervention to have long-lasting impacts on educational, economic, and health outcomes in adulthood (e.g.,

Deming, 2009; Olds, 2006; Reynolds et al., 2019). The nearly universal consensus from the research community on the positive potential of these programs was in turn disseminated to many audiences (Phillips et al., 2018; Yoshikawa et al., 2013), contributing to recent explosions in the availability and funding of early childhood services.

Importantly, these landmark studies and their contemporary counterparts have largely been judged based on their ability to impact academic skills. Using data from a recent systematic review (Draper et al., 2022; See Supplemental Material A and original study for details), we demonstrate in Figure 1 that nearly half (49.1%) of outcome measures used in evaluations of interventions for preschool-age children since 1990 have focused on academic skills, making them by far the most commonly mentioned intervention targets; the second most common outcomes were social-emotional skills, which were measured in only 15.9% of cases. In many ways, this emphasis on academic outcomes makes sense. Supporting early language, literacy, and math skills is a key goal of many early childhood interventions, as these competencies prepare children to successfully navigate primary school and beyond. Measures of academic skills are also relatively easy to collect, psychometrically robust, and associated with long-term outcomes (e.g., Watts et al., 2014). Their consistent use also allows for comparability across time, context, and study. Indeed, the fact that measures such as the Woodcock Johnson have been used in evaluation research since the 1960s is one reason why the field has been able to build a cohesive, directly comparable evidence base regarding early intervention effectiveness.

At the same time, focusing narrowly on academic skills likely comes with costs. Researchers have speculated that patterns of early intervention “fade-out” – or diminished program effectiveness over time – may be explained by the field’s over-reliance on basic academic assessments (Bailey et al., 2017; McCormick et al., 2021). Because non-treated

children are able to quickly acquire or “catch up” on rote numeracy or literacy knowledge once they enter elementary school, the treatment-control differences in these skills converge quickly, giving the appearance of fade out (Bailey et al., 2017). Accordingly, evaluations that rely on measures of basic academic knowledge as key indicators of success may lead to overly pessimistic conclusions regarding the durability of impacts produced by high-quality interventions, as well as questions about how and why some programs have managed to identify impacts into adulthood. Indeed, several reviews have shown that the long-term effects of early interventions are largely unexplained by immediate impacts on academics (Elango et al., 2015; Hart et al., 2023). Importantly, these same reviews suggest that impacts on other typically measured domains (e.g., social-emotional skills) may account for some, but not all variance in later outcomes. Collectively, this work suggests that traditional approaches to measurement are falling short in explaining long-term impacts.

Beyond implications for research, the field’s emphasis on academic outcomes may also have practical ramifications. In particular, academic-focused assessment frameworks may play a role in the so-called “academicization” of early childhood interventions, or the bringing down of developmentally inappropriate elementary school methods into the early childhood space as a result of accountability pressures to improve children’s academic performance (Bassok et al., 2016). Both researchers and educators have raised concerns that academic frameworks may incentivize teaching children to memorize letters and numbers instead of using the sorts of play-based, child-centered methods that have been shown to support broader learning and development (Fisher et al., 2011; Little et al., 2020; Whitaker et al., 2023). Such over-alignment between what is tested and what is taught may, in turn, lead to overly optimistic views regarding the true impacts of academicized programs.

Finally, critics have argued that existing approaches to evaluating early childhood interventions are overly deficit-oriented and color-blind. The field of early intervention has a long legacy of trying to “fix” low-income communities of color and ignoring the sociohistorical contexts of these same communities. As Bruno & Iruka (2022) note, for example, the objective of the Abecedarian program was to provide a “socially disadvantaged” group of children – 98% of whom were Black – “with an intellectually stimulating environment from early infancy” to “prevent the development of mild mental retardation” (Ramey & Campbell, 1984). This approach makes deficit-based assumptions about the cognitive abilities of low-income, minoritized populations, while also ignoring their multitude of strengths. Although asset-based measures of children from minoritized and low-income backgrounds have existed for decades (e.g., Jones, 1996), these measures have largely not made their way into intervention research or accountability systems (Bruno & Iruka, 2022).

### **Defining FOLD Skills**

To address these challenges, we propose to expand existing frameworks for defining “success” in early childhood intervention research to include a broader set of skills<sup>1</sup> that we term the foundations of learning and development (henceforth “FOLD skills”). We define FOLD skills as meeting four theoretical criteria: First, as their name implies, FOLD skills are *fundamental* to other forms of learning, development, and knowledge acquisition. In particular, these skills serve as key means through which children acquire traditionally emphasized “domain specific” academic, social-emotional, cognitive, and motor competencies (see Figure 2). Second, FOLD skills are *cross-cutting*, such that they support domain-specific skill development, but

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<sup>1</sup> We use the term “skills” for parsimony’s sake, though recognize that the constructs described here include both skills, as well as a broader set of competencies and capacities that children acquire with maturation and environmental support.

cannot themselves be cleanly categorized as cognitive, social-emotional, etc. Third, FOLD skills are *active* and *dynamic* in nature, such that they are formed continuously through children's hands-on engagement, reflection, and interaction with the physical and social world. Finally, FOLD skills are *developmentally salient*, with a sensitive period for their formation occurring during the preschool period.

FOLD skills – and the four criteria used to define them – are not new. Indeed, as long ago as the early 20th century, theorists like Piaget and Vygotsky described the ways in which children act as “little scientists,” using constructivist skills to actively and playfully explore their environments, gather information, make meaning of this information, test hypotheses, and generalize knowledge (Piaget, 1937; Vygotsky, 1978). More modern, 21<sup>st</sup> century frameworks like the 6Cs (Golinkoff & Hirsh-Pasek, 2016), trifecta skills (Bailey et al., 2017), and approaches to learning (U.S. Department of Health & Human Services, 2022) have also described a similar set of competencies that children need to innovate, manage competing information, and thrive in contexts characterized by diversity and change. By bringing together these frameworks, our goal is to concretely define FOLD skills in a way that facilitates the future identification of new FOLD competencies, as well as the mapping of commonly measured skills onto these criteria.

For the purposes of this paper, we identified six initial FOLD skills for further consideration as intervention targets. The specific process we used to identify these six skills is detailed in Supplemental Material B. Briefly, we (the authors of this paper) and a team of six doctoral and post-doctoral research assistants worked both independently and collectively to iteratively generate an expanded list of possible outcomes of early childhood intervention. This list borrowed from popular research and policy frameworks (e.g., constructivist skills, Head Start Early Learning Outcomes Framework), as well as less-well-known frameworks relevant to

historically marginalized populations. For example, our initial list included constructs shown in prior literature to reflect Majority World values systems (Draper et al., 2023). We then refined this list by collapsing similar constructs (e.g., combining self-regulatory constructs such as inhibition and behavioral regulation into a single category of “self-regulation and executive function”) and excluding outcomes that did not meet our criteria for FOLD skills. In particular, we excluded domain-specific skills (e.g., prosocial skills, fine motor skills, literacy skills, storytelling), as well as health, motivational, and other non-skill-based outcomes. Given known inconsistencies in how skills are defined and categorized in this age period (Beisly, 2023), we acknowledge that this process was subjective (see Supplemental Material B and Gaps and Future Directions section, below, for details). Nevertheless, this iterative process yielded six FOLD skills that we focus on for the remainder of this paper: curiosity, creativity, self-regulation and executive function, critical thinking, perspective taking, and internal representations of self.

As we highlight in Figure 1, our six identified FOLD skills are largely absent from the existing evaluation literature. Indeed, just 146 of the 1,149 outcome measures used in early childhood evaluations since 1990 – a total of 12.7% – reflect one of these FOLD skills. Although representation of FOLD skills appears to be on the rise (see Figure A1 in Supplemental Material A), this trend is driven by an increased use of self-regulation and executive function measures. Indeed, 135 of the 146 measures of FOLD skills (92.5%) focused on self-regulation and executive function, whereas the remaining 11 reflected either critical thinking ( $n = 8$ ) or perspective taking ( $n = 3$ ). This means that no early childhood intervention published in the last 30 years has been evaluated based on its ability to specifically improve children’s curiosity, creativity, or internal representations of self – key competencies that we argue underlie long-term well-being.

### **Evidence on the Practical Viability of FOLD Skills as Early Intervention Targets**

Overall, there is ample theoretical evidence that children's acquisition of FOLD skills during early childhood is critical for their broader development and well-being, and yet these skills are by and large not being included as measured targets of intervention research. A natural question therefore follows: *Should* they be? To answer this question, we reviewed the literature on the practical viability of including our six FOLD skills as targets of early intervention.

Specifically, we argue that to be included as intervention outcomes, FOLD skills must be:

1. *measurable*, with evidence for reliably and validly using reasonable (read: practically viable) assessment methods;
2. *malleable*, or sensitive to environmental inputs / intervention;
3. *predictive* of other important outcomes (e.g., academic performance) in the early childhood period and beyond; and
4. *universal*, with evidence to suggest that the skill manifests similarly and is meaningful across a range of groups and cultural contexts.

To provide evidence on these four criteria, we conducted a large-scale literature review that included 340 articles targeting FOLD skills in children between the age of three years and kindergarten entry. Although this review was not systematic, studies were intentionally selected to reflect a wide range of disciplines, methodological approaches, populations, and periods. Details of this review – including example search terms, full inclusion/exclusion criteria, and coding criteria – are available in Supplemental Material C. Briefly, the review was conducted between January and April, 2022 by the same research assistant coders who helped to identify the initial list of FOLD skills. After completing a day-long training, we (the study authors) and the coders collectively searched for, screened, and extracted information from studies on the first

FOLD skill (curiosity) to build consensus and refine study protocols. Coders then worked in teams of two to three to complete this same process for each additional FOLD skill. The codebook used for data extraction focused largely on basic study characteristics and the four practical criteria listed above (e.g., measurability, malleability) and can be found at <https://osf.io/2ntvd/> (McCoy & Sabol, 2024). After coders agreed that saturation had been reached for a given skill, they worked together to produce an evidence summary, including a four-point rating of the evidence available for each practical criterion. Questions and discrepancies were addressed through weekly group meetings, as well as via email and Slack. This study was not pre-registered.

Findings from our review are summarized in Table C2 in Supplemental Material C.

Below we discuss these findings in greater detail for each identified FOLD skill.

### ***Curiosity***

In the most basic terms, we define curiosity as *children's desire to know more, or their thirst for knowledge*. Curiosity is often studied and conceptualized alongside phenomena including exploration, novelty-seeking, and question-asking. It is also known to be a multidimensional construct, with conceptualizations varying depending on the topic of inquiry, whether curiosity is thought of as stable (trait) versus dynamic (state), and the motivational factors underlying individuals' desire for knowledge (Ainley, 2019; Jirout & Klahr, 2012).

Overall, we found numerous studies describing the *measurability* of curiosity. Although there is no single gold standard measure of overall curiosity, its subdimensions can be reliably measured using various modalities, including adult reports, parent diaries (e.g., about children's question-asking), direct assessments, and observational approaches. For example, one approach for measuring curiosity is to score children's exploratory behaviors while interacting with a

“curiosity box” that includes many manipulatives (levers, doors, bells, knobs, etc.; Banta, 1968). We found substantially less evidence regarding our other practical criteria. Based on available evidence, we conclude that curiosity is likely to be *malleable*, *predictive* of other outcomes, and *universally* relevant. However, these general conclusions come with certain caveats. For example, although studies taking a state-like view of curiosity have shown responsivity to inputs such as parental guidance (e.g., Endsley et al., 1979), many studies have operationalized curiosity as trait-like and stable across situations/time, and accordingly did not probe for malleability. Similarly, whereas studies have shown curiosity to correlate with other meaningful outcomes (e.g., IQ, reading and math achievement, competence motivation, attention/persistence), these associations were sometimes shown to be weak and/or inconsistent across subgroups (e.g., based on socioeconomic status; Shah et al., 2018). Finally, although studies of curiosity in different parts of the world have highlighted the apparent universal relevance of this construct, the lack of cross-culturally validated measures of curiosity has precluded nuanced comparisons. Furthermore, studies probing within-setting differences have identified variability in terms of how different groups (e.g., parents, teachers) perceive and value curiosity (e.g., Jukes et al., 2021).

### ***Creativity***

We define creativity as *children’s ability to generate a variety of new ideas and associations*. Like curiosity, creativity is multi-dimensional, comprising subskills such as fluency, flexibility, originality, and elaboration (Guilford, 1957). Creativity is conceptually related to constructs such as imagination, playfulness, and curiosity. In particular, both creativity and curiosity share an emphasis on novelty, but curiosity tends to focus on children’s interest in knowing more, whereas creativity considers how children actually engage with the world, often

as a means of quenching their curiosity or reaching a particular goal.

As with curiosity, we identified ample evidence to confirm the *measurability* of creativity. Direct assessments were used most, with motor (e.g., drawing) tasks being preferred over verbal tasks for young children who are still developing their language skills. For example, the Torrance Test of Creative Thinking (Torrance, 1966) is a classic paradigm in which children are asked to come up with novel responses to a series of verbal and drawing tasks (e.g., producing drawings that incorporate a set of pre-specified lines). We also found numerous studies highlighting the *malleability* of creativity, including observational studies identifying correlations between different types of classroom practices and children's creativity, as well as small-scale intervention studies showing the positive impacts of "creativity training" approaches. Other work, however, emphasized differences in creativity across age and sex, highlighting that observed variability in creativity may not always be attributable to modifiable factors. We found somewhat less evidence regarding the *predictive validity* of creativity measures. In general, this evidence identified modest correlations between creativity and conceptually related constructs (e.g., pretend play), with less known regarding how creativity relates to other salient individual outcomes (e.g., academic performance, social skills). Finally, although creativity is conceptualized as both an individual and sociocultural phenomenon, empirical research on the *universality* of creativity is somewhat limited. Several studies point to the cultural specificity of different types and perceptions of creativity, with East Asian societies placing greater emphasis on group-based creativity, for example (Taylor & Rogers, 2001). As with curiosity, the lack of validation and norming of creativity measures outside of Western settings has constrained research regarding the universality of creativity.

### ***Critical Thinking***

Next, we examined critical thinking, which we define as how individuals *analyze, interpret, and explain information, question evidence, and come to an informed conclusion or solution*. Critical thinking refers to the broader mental process of thinking with logic or reasoning in order to synthesize and analyze complex information. Critical thinking includes many sub-domains, including problem solving skills related to children's strategies used to uncover novel solutions to a problem (Riley, 1998).

The *measurability* of critical thinking is somewhat limited due to the challenge of eliciting children's "inner speech." Most critical thinking studies use structured interviews or drawing activities to capture children's thinking patterns. For example, Yaralı and Aytar (2020) developed the Critical Thinking Skills Test for 5–6-Year-Old Children, which presents children with child-friendly stories and asks them questions across multiple subscales of critical thinking (interpretation, explanation, evaluation, inference, and analysis) to uncover their mental processes. For the sub-domain of problem solving skills, the field is much more advanced in terms of measurement. For example, direct assessments in which children are asked to solve a problem (e.g., logic game with a ball in a maze; experiment with pipe cleaner in tube; Keen, 2011) can be used to code children's errors and successes, both of which are informative about the child's thinking and level of planning. Matrix reasoning and reaction time tasks are additional examples of problem solving measures. In matrix reasoning tasks, for example, children are assessed on their ability to apply logical rules and strategies to mentally reconstruct a missing piece of a matrix (Gonthier et al., 2024).

Experimental work in both labs and classrooms demonstrates modest evidence that critical thinking is *malleable* based on environmental inputs. For example, the Reggio Emilia approach – which provides students with opportunities for child-centered active exploration,

discovery, and investigation – has been associated with growth in critical thinking skills (Fernández-Santín & Feliu-Torruella, 2020). Furthermore, there is some limited research on the *predictive* power of critical thinking on later outcomes such as academic achievement, executive function, and social relationships. In terms of *universality*, there are some studies demonstrating the development of critical thinking in international contexts including Indonesia (Priyanti & Warmansyah, 2021), Spain (Fernández-Santín & Feliu-Torruella, 2020), Turkey (Yaralı & Aytar, 2020), and indigenous populations within countries (e.g., Brazil, Papua New Guinea, Australia), but limited cross-cultural research.

### ***Self-regulation & Executive Function***

We define self-regulation and executive function as a collective set of *skills that are used to monitor and manage internal states and behaviors in the service of reaching a particular goal*. Self-regulation and executive function contain numerous sub-skills that are thought to work together to facilitate goal-directed behavior. In our review, we focused predominantly on executive function, which is often considered to comprise three cognitively-based sub-constructs – inhibitory control, working memory, and cognitive/attentional flexibility (Miyake et al., 2000) – that collectively support children’s broader behavioral and emotional self-regulation. Self-regulation and executive function likely support nearly all other FOLD skills given these constructs’ shared emphasis on working toward specific goals.

The literature on self-regulation and executive function has exploded in recent years and is still relatively new compared to that of other constructs in this review (e.g., curiosity, critical thinking). We identified an especially large body of research supporting the *measurability* of self-regulation and executive function skills using caregiver surveys, direct behavioral assessments, and tablet- or app-based approaches. Many measures of executive function in

particular leverage common underlying paradigms to target specific sub-constructs (e.g., a go/no-go paradigm for measuring inhibitory control), whereas few capture executive function skills comprehensively. We found slightly less research - though still a substantial amount - focused on *malleability*. This work included both (1) observational studies examining environmental and behavioral correlates of self-regulation and executive function skills (e.g., parenting behaviors, physical activity), as well as (2) evaluation studies examining the effectiveness of direct interventions designed to “train” executive function skills. Studies in both categories pointed to the sensitivity of executive function to environmental inputs, with slightly more mixed evidence (some positive, some null results) within the more empirically rigorous intervention literature. We also found some evidence for the *predictive validity* of self-regulation and executive function skills. In particular, studies have found cross-sectional associations in the early childhood period amongst various self-regulation and executive function sub-constructs, as well as between these sub-constructs and other outcomes (e.g., pre-literacy skills, motor skills). A smaller number of longitudinal studies have also linked these skills with later academic performance. Finally, although a growing number of studies using Western measures have found that children exhibit similar levels of self-regulation and executive function skills cross-culturally, less work has probed for the more fundamental *universality* of these skills. Whereas some researchers have advocated for the universal nature of executive function skills specifically (Obradović & Willoughby, 2019), others have speculated that, by virtue of their goal-directed nature, self-regulation and executive function skills are likely to manifest differently or retain different value across contexts (Haslam et al., 2019). If true, this suggests that any efforts to measure, intervene upon, or understand the predictive validity of self-regulation and executive function skills should be targeted toward the goals of the particular group or context (Jukes et al., 2024).

### ***Perspective Taking***

Perspective taking is *the ability to recognize and reason about the mental state of others*, for example, their goals, desires, knowledge, beliefs, and emotional states. Perspective taking historically was conceptualized as a domain-specific social-emotional skill, but more recent work suggests that it is cross-cutting and includes the ability to recognize the perceptual/visual, cognitive/conceptual, and affective/emotional states of others (Birch et al., 2017), hence making it a candidate as a FOLD skill. Indeed, the question of how individuals develop perspective has deep roots in developmental psychology. Piaget proposed that young children's egocentrism prevents them from shifting from their point of view to reason about perspectives other than their own. For example, in the now-famous Mountain Task, children were asked to take the visual perspective of a doll sitting on the opposite side of the table (Piaget & Inhelder, 1956). Since Piaget's original ideas, a host of *measures* of perspective taking have been developed and validated, providing evidence that it is a cross-cutting construct (Bensalah et al., 2016). For example, in a measure about children's affective/emotional perspective taking, children watch videos of other children and are asked to guess how the children in the video may feel in a given situation (Mossler et al., 1976).

There is some evidence that perspective taking is *malleable* and can be improved through various educational strategies, although effects have mainly been found in the visual/perceptual domain. In addition, there are differences in findings on malleability by cultural context. For instance, an experimental study found that Chinese preschool children's perspective taking was not improved by initially allowing children to choose a desired item for themselves, whereas prior desire fulfillment did predict children's perspective taking in North American children (Guan et al., 2020). There is also some evidence for *predictive validity*, where perspective taking

is correlated with language development, social-emotional skills, and executive function in Western samples. Yet, again, the relation between perspective taking and later outcomes was culturally bound, and not found in studies based in Korea, China, and Japan (Guan et al., 2020). Indeed, there may be some *universality* of the construct itself, but the ways in which it manifests is highly dependent on sociocultural contexts. For example, children who grow up in cultures with more collectivistic and interdependent beliefs may have stronger perspective taking skills compared to children from Western cultures that value individualism and independence (Killen & Wainryb, 2000). Despite some emerging evidence demonstrating the different rates of perspective taking (and malleability of these skills) across contexts, there are few studies testing its universality across multiple cultures and contexts.

### ***Internal Representations of Self***

Although less established compared to other skills in this review, there is strong theoretical support and some emerging empirical evidence suggesting the importance of what we are collectively calling “internal representations of self” for children’s early and later development (Bandura, 1983). We define internal representations of self as *children’s meaning making of themselves* as related to their own attributes, characteristics, behaviors, competencies, and/or broad social categories such as race, gender, and social status (Umaña-Taylor, 2015). Historically, researchers theorized that true “identity development” did not occur until middle childhood or adolescence. Recently, researchers have pushed against this assumption and focused on young children’s internal representations of self across a number of sub-domains – including self-awareness, self-representations, perceived competence, and perceptions of self – that are theorized to be the stepping stones to later identity formation. While internal representations of self meet the criteria for this review of being fundamental, dynamic, cross-

cutting, and developmentally salient, there is still much work that needs to be done in terms of measuring this skillset, establishing concurrent and predictive validity, and understanding malleability and universality. We therefore consider internal representations of self as a promising candidate FOLD skill worthy of future inquiry and confirmation.

One major roadblock for studying internal representations is the challenge of tapping into the “inner selves” of young children. Like critical thinking, the *measurability* of this skillset requires eliciting reliable self-reports from younger children, which is made challenging by several developmentally dependent factors, including limited expressive language skills and attention spans and concerns about accuracy. Encouragingly, there are well-established measures from clinical psychology, such as the Berkeley Puppet Interview, that use live, interactive puppets to assess children’s internal representations of their own behavior and academic competency that suggest the feasibility of measuring how young children make meaning of their own lives (Measelle et al., 1998). Researchers have recently adapted this approach for tablets, using child-friendly avatars that voice opposing statements (e.g., I like school/I don’t like school) to measure children’s perceptions of themselves (e.g., their own academic competence; Sabol, Busby, & Hernandez, 2021). There are also new tools that assess young children’s self-awareness of their racial/ethnic membership and social status that rely on similar strategies (e.g., Me/Not Me Task; Rogers & Melzoff, 2017), demonstrating the measurability of internal representations across multiple domains of the self.

In terms of *malleability*, most research examines how children's views of themselves change over time, focusing more on developmental shifts rather than changes due to variation in contextual experiences. Some work has highlighted the challenges of changing internal representations in the context of broader societal biases. For example, past research has found

that preschool-aged girls have lower levels of perceived competence in mathematics compared to boys. Preschool interventions to combat this competence “gap” led to improvements to girls’ math skills and problem-solving behavior, but did not lead to changes in internal representations of competency (Verschueren et al., 2001). There is very little evidence on the *predictive validity* of internal representations of self. Most work finds that perceived academic competence predicts academic achievement, but perceived competence in one domain (e.g., academic competence) does not relate to outcomes in other domains (Dapp & Roebbers, 2018). Finally, in terms of *universality*, evidence from Western contexts demonstrates some differences in self-awareness by gender, age, and race, positioning internal representations of self as a key indicator of strength among minoritized children in the United States. For example, based on qualitative and observational methods, recent research has found that preschool-age Black children in the US are aware of racial bias against Black people, and they actively resist internalizing this stigma in their own internal representations in order to foster positive views of their own racial category and sense of self (Rogers & Way, 2018). However, there is very limited research across international contexts, limiting understanding of cross-cultural variability.

### **Gaps and Future Directions**

In sum, evidence from our review suggests that curiosity, creativity, critical thinking, self-regulation and executive function, perspective taking, and internal representations of self may be viable outcome targets for future early childhood interventions. Indeed, we identified evidence that each of these FOLD skills is measurable, malleable, predictive of other important outcomes, and relevant across diverse populations. Nevertheless, additional work is needed before making broadscale investments in the assessment of FOLD skills (see Box 1).

First, and most broadly, the conceptual framework for studying, identifying, and

categorizing FOLD skills must be refined. The review presented here is not definitive, but rather the first step in a longer process of clarifying FOLD skills' definitions and conceptual boundaries. As noted throughout our review, FOLD skills relate to one another in complex ways. For example, a child's curiosity may be satisfied through creativity, and their creativity may enable them to see things from a different perspective, which in turn may support their problem solving (Sternberg et al., 2021). Similarly, although we conceptualize FOLD skills as underpinning domain-specific skill development, the relations between these skill types are likely to be bidirectional (see Figure 2). For example, children's acquisition of language and motor skills likely facilitates their ability to satisfy their curiosity, to develop regulatory strategies, etc. Future work should unpack these relations in ways that both delineate these various skills as well as further clarify their interconnectivity.

It is also highly likely that other skills beyond the six reviewed here could be considered as FOLD skills based on our theoretical criteria. In particular, there may be elements of academic competencies – which, for the purpose of this paper, we have conceptualized as domain-specific – that are, in fact, fundamental and cross-cutting. Research suggests that children's academic performance draws from multiple types of skills, with preschool interventions demonstrating less durable impacts on acquired knowledge and rote skills (e.g., counting, addition, subtraction) relative to the broader set of skills that support the acquisition, integration, and application of that knowledge (e.g., patterning, spatial imagery; McCormick et al., 2021). It is therefore possible that this latter set of skills may actually be more FOLD-like than domain-specific. Similar conclusions could also be drawn about skills that have traditionally been categorized as social-emotional in nature. Future research is needed to identify FOLD skills not reviewed here, as well as to consider whether dimensions of domain-specific skills may meet FOLD criteria.

Second, related to measurability, further work is needed to formally operationalize FOLD skills in applied contexts. Findings from our review suggest that some FOLD skills can be reliably and accurately measured using a variety of approaches. Nevertheless, work to measure these skills has largely been based in laboratory settings, raising questions about the feasibility of operationalizing these skills the real-world (Maves, 2022). The creation of a scalable, inexpensive, inclusive toolkit for measuring children's FOLD skills will be a critical next step for building a more rigorous evidence base and supporting the viability of these skills as targets of future intervention and accountability systems.

Third, related to malleability, our conceptual framework should be expanded to reflect the factors that facilitate or impede FOLD skills' growth. We speculate that these skills share a common set of bioecological predictors. In particular, a growing body of evidence has shown that different forms of play (e.g., guided, social) may facilitate FOLD skill development (Yu et al., 2018). There is also research from multiple disciplines, including developmental psychology, sociology, anthropology, and economics, that highlights the central role that relationships with parents, teachers, and other adults play in supporting young children's acquisition of FOLD skills (e.g., Berger & Luckmann, 1967; Bronfenbrenner, 1979). However, we hypothesize that each FOLD skill is also likely to be affected uniquely by different forces. Although beyond the scope of the present article, identifying both the general and specific approaches that shape FOLD skill development in real-world settings could help practitioners and policymakers to make more informed decisions for selecting interventions that are aligned with their developmental goals. Such evidence could also help researchers to identify the FOLD skills that are most likely to be impacted by a particular program, in turn avoiding unnecessary measurement of less relevant constructs.

Fourth, related to predictive validity, additional work is needed to understand whether and how FOLD skills predict other developmental processes in childhood, adolescence, and beyond. Indeed, the goal of this article is not to dismiss the importance of traditionally-measured skillsets or to suggest that FOLD skills should replace them as the sole targets of intervention, but rather to draw attention to the ways in which FOLD skills may serve as an early, common means through which learning and development occurs. Evidence from our review suggests that many FOLD skills are correlated with traditionally-measured competencies such as children's math and reading performance. Early FOLD skills may also facilitate the development of progressively more complex phenomena from later childhood into adulthood (e.g., complex cognition or racial/ethnic identity in adolescence; Sternberg & Ben-Zee, 2001; Quintana et al., 1999). Nevertheless, the longitudinal and causal evidence undergirding these conclusions is relatively weak (Bailey et al., 2018). There is a dearth of evidence, for example, regarding whether FOLD skills may predict later outcomes better than early academic skills, or above and beyond environmental characteristics such as children's socioeconomic status. Furthermore, very little is known about how FOLD skills may undergird longer-term outcomes that are important to families and communities, but infrequently prioritized in quantitative research, policy, and practice (e.g., happy relationships, personal fulfillment, Ettinger et al., 2022). More research using rigorous study designs and rich measures is therefore needed to explore how FOLD skills may support "success" across a wider range of developmental periods and domains. Applying new measures of FOLD skills within longitudinal intervention evaluations may be a particularly promising means for establishing the predictive validity of these skills, while also generating more causal evidence regarding the mechanisms underlying longer-term intervention effects.

Fifth, related to universality, future studies of FOLD skills must be more inclusive of the

perspectives of traditionally minoritized populations. Much of the literature on which our conclusions are based portrays findings from Western, White samples and researchers as the norm and generalizable to all individuals (Moriguchi, 2022; Roberts & Mortenson, 2022). Our findings are thus reflective of what *was* and *is* in research rather than what *could* or *should be*. Indeed, one theme of our review is that published academic literature speaking to the cross-cultural universality of these FOLD skills is scant. For example, there are well-documented cultural differences in children's ways of working together, a skillset we explored but did not ultimately include in our review due to its domain-specificity as a social-emotional construct. Children from Indigenous-heritage backgrounds within the Americas often employ a highly sophisticated form of collaboration, in which children think together and blend ideas with others (Mejía-Arauz et al., 2007). In contrast, children from European American middle-class backgrounds have been found to rely on turn taking which did not allow co-thinking (López et al., 2012; Rogoff et al., 2017). This type of comparative work that highlights the strengths of minoritized populations is under-represented in the literature and in practice. Future research that more directly incorporates the experiences, perspectives, and priorities of diverse populations will be critical for more accurately understanding the universality of FOLD skills, as well as for shining light on additional, under-researched skills relevant for the diverse groups who increasingly make up the majority of the world's children (McCoy, 2022, Medin et al., 2017).

## **Conclusion**

Just as “science cannot study what it cannot measure accurately and cannot measure what it does not define” (Durlak & DuPre, 2008), practice cannot improve what it does not target. We argue that the field of early childhood intervention has lost sight of both its conceptual roots and its present reality by focusing narrowly on a set of largely academic outcomes. This so-called

“streetlight effect” means that developmental psychologists remain in the dark regarding the more fundamental impacts that early interventions are (or should be) having on children’s skill development. Even more problematically, this measurement gap may be fueling accountability pressures that incentivize improvements in a set of rote academic outcomes that is misaligned with the developmental needs of diverse children.

In this article, we begin to address this “streetlight effect” by illuminating a preliminary set of fundamental, active, cross-cutting, and developmentally salient skills that show evidence for measurability, malleability, predictive validity, and universality. Although a number of open questions remain, on the whole the evidence in our review confirms that there is more to early childhood development than ABCs and 123s (McCormick & Mattera, 2022). From the foundational theories of Piaget and Vygotsky to the contemporary work of researchers studying the strengths of minoritized, diverse populations, the field of developmental psychology continues to lay a substantive foundation for understanding and supporting the needs of young children. The goal of this article has been to provide a critical review of this knowledge and, in doing so, to shine light on a set of FOLD skills that could complement traditionally measured skills as additional target outcomes of early interventions. We argue that including measures of FOLD skills in intervention evaluations could generate a more precise understanding of the myriad ways that early childhood programs impact children. With time, this expanded list of target outcomes could also help to incentivize the creation of more holistic and developmentally-informed programs that are equipped to support the learning and development of *all* children. In creating a framework for understanding and studying FOLD skills, we hope to lay the foundation for a new era of more effective, equitable, and evidence-based research and practice.

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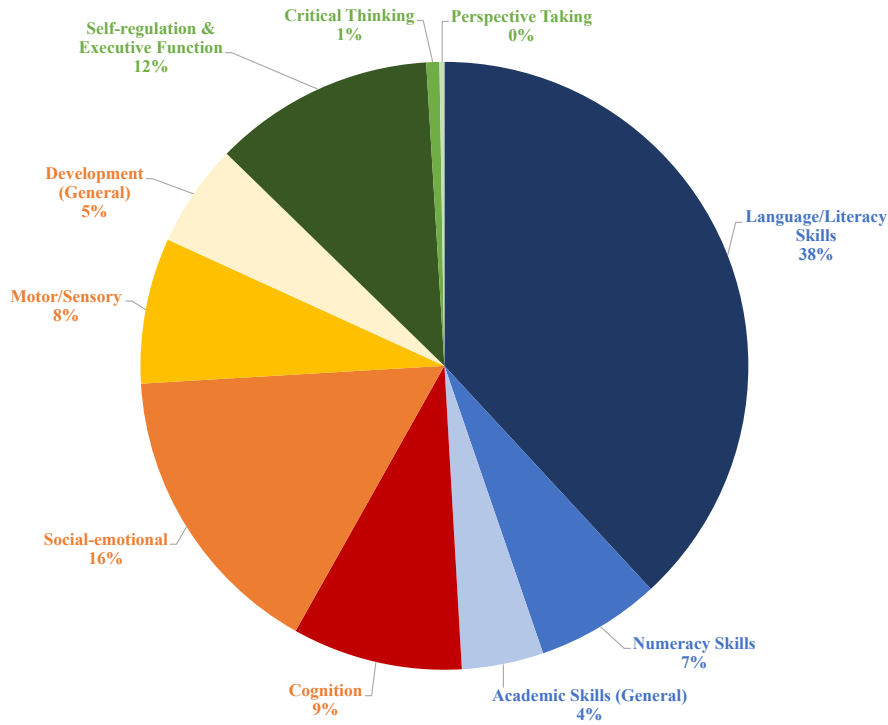
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**Figure 1**

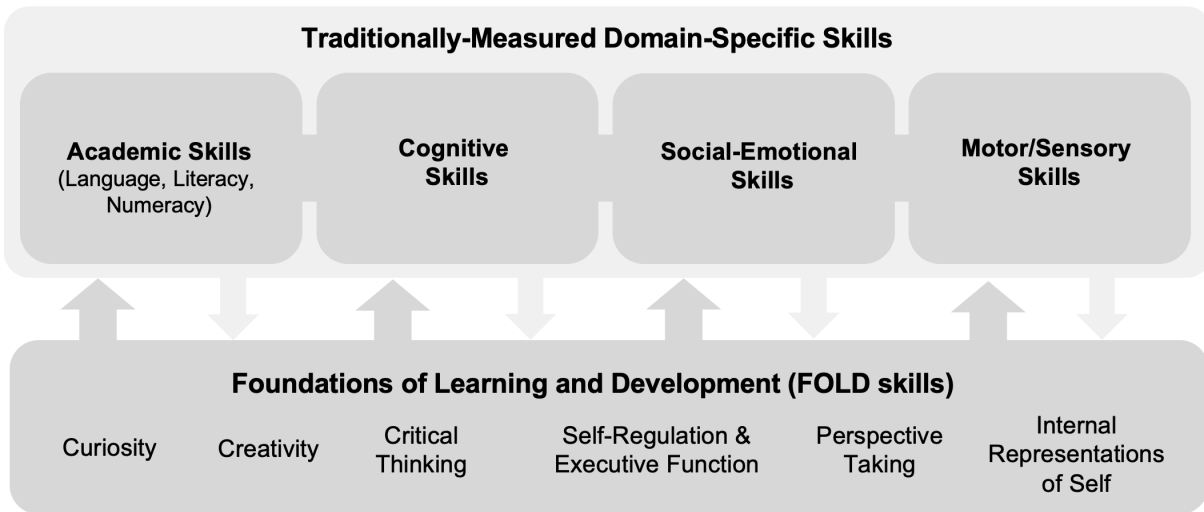
*Outcomes measured in early childhood interventions for ages 3-5 (N = 1,149 outcomes in 572 studies)*



*Note:* Blue represents academic skills; red/orange represents other non-academic, domain-specific skills; and green represents the FOLD skills proposed in this paper; Data taken from a systematic review of early childhood interventions (e.g., early childhood education, home visiting) conducted worldwide by Draper et al., 2022; See Supplemental Material A for details.

**Figure 2**

*Conceptual overview of FOLD skills and their relations with traditionally-measured domain-specific skills*



**Box 1***Future directions in the study and prioritization of FOLD skills*

1. Continue to refine the conceptual framework for FOLD skills, including what specific constructs they include, how they relate to one another, and how they relate to and are distinct from domain-specific skills
2. Create an open-access toolkit for measuring these FOLD skills, with an emphasis on scalability and interpretability to optimize relevance for real-world purposes
3. Identify the environmental inputs that most directly support the development of these FOLD skills, beginning with play and caregiver interactions
4. Formalize the ways in which these FOLD skills lead to the development of more traditional domain-specific competencies (e.g., literacy and math knowledge) and other outcomes valued by diverse community experts (e.g., fulfillment, relationships)
5. Expand the study of these FOLD skills in more representative populations, with particular attention to exploring established these skills and identifying new skills for minoritized children