Towards Clarity in Research on “Non-Cognitive” Skills: Linking Executive Functions, Self-Regulation, and Economic Development to Advance Life Outcomes for Children, Adolescents and Youth Globally

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Human development and economic development are intrinsically linked. Guided by human capital theory, economists are increasingly recognizing the importance of a range of other skills – in addition to intelligence and technical skills – for economic success. Until fairly recently, years of education completed, literacy, numeracy and IQ – often used as proxies for cognitive ability – were the main measures used to assess the relationship between human capital and economic development. More recently, researchers and practitioners have acknowledged that skills such as the ability to work in groups, maintain good interpersonal relations and a positive attitude, control impulses and demonstrate goal-directed behavior are all critical to economic productivity and individual success. The economist James Heckman highlighted the importance of these skills, which he originally called “non-cognitive” skills, for economic development in 2006 [Heckman, Stixrud, & Urza, 2006]. Since that time, there has been considerable interest among the international development community in these skills, but also confusion as to how to conceptualize, define, and assess this set of skills, and above all, how to foster them. Recent writings by Heckman refer to these skills as “character skills” while others have termed them “life skills,” “21st century skills,” “socio-emotional skills,” or “soft skills.” Regardless of the term used, many of these skills fall under the more clearly defined umbrella of executive functions and self-regulation. While these skills, or more aptly, *competencies* necessary for healthy and productive lives have been referred to as “non-cognitive,” in fact cognitive processes are at the heart of self-regulation. Such brain processes allow us to flexibly regulate emotions, control anger or strong emotional reactions and maintain calm under pressure according to the demands of a particular context. These domains of

brain function have a rich history of research in the study of human development involving disciplines ranging from psychology and neuroscience to behavioral economics. We should build upon this extant and growing knowledge base as we seek to incorporate these skills into research and programming to advance human and ultimately global economic development.

As we progress in global health and development, greater interdisciplinary collaboration is needed to deepen our understanding of the nuts and bolts of what economists refer to as human capital formation. Cross-disciplinary collaboration can facilitate our understanding of the connections between executive function and self-regulation and their links to human capital formation and economic self-sufficiency.

Self-Regulation, Executive Functions and Emotions

Research on self-regulation has struggled with significant conceptual fragmentation. Concepts and constructs such as executive function, self-control, cognitive control, emotion regulation, impulse control, volition or willpower, attentional control, behavioral inhibition, and so forth are inherently interrelated and sometimes used interchangeably across disciplines and literatures. While different researchers vary in what elements of regulatory processes they emphasize, they tend to agree that emotions regulate behavior, higher-level cognitive processes play an important role in emotion regulation, and non-volitional regulation can occur as well. Thus, it is important to incorporate physiological or neuroendocrine factors and processes into the study of self-regulation and socio-emotional skills. For the development agenda to advance using insights from neuroscience, concerted effort is needed to identify key factors of self-regulation and its associated socio-emotional skills that can be effectively incorporated into interventions and evaluations to improve opportunities for investing in children, adolescents, youth and families globally, particularly in settings affected by violence and other forms of extreme adversity.

Executive function is an umbrella term that refers to the following mental processes: *working memory* or the capacity to hold and manipulate information over short periods of time, *inhibitory control* or the ability to master and filter thoughts and impulses and to pause and think before acting, and *cognitive or mental flexibility* such as the ability to shift attention between tasks. While executive functions refer to specific higher-order cognitive processes, they are intimately connected with emotions. A large body of research has investigated emotion regulation and how the capacity to regulate emotions relates to social functioning, health and wellbeing, as well as educational achievement and labor market outcomes. Studies from neurobiology to behavioral economics show that emotions affect a person's ability to self-regulate and that effortful regulation affects cognitive abilities and subsequent self-regulatory capacity. Thus, it should not surprise anyone that executive functions and self-regulatory capacity are linked to a range of interpersonal, behavioral, and cognitive outcomes, from educational and career achievement to physical and mental health outcomes to productive and healthy relationships. Effective self-regulation and executive functions go beyond knowing how to behave in an interview, or knowing about the risks of unsafe sex, topics often targeted in interventions under the rubric of "soft skills," or "life skills." Of course this knowledge is important, but it is of little use unless one has the capacity to execute this knowledge in the heat of the moment.

Insecurity, fear and other repeat stressors during childhood and adolescence can have significant and lasting consequences often expressed as deficits in executive functioning and emotion regulation [Shonkoff & Garner, 2012]. These deficits can be observed at the neural level both in structural and functional differences. In addition, how children experience such stressors is influenced by parental states and behaviors, particularly in early childhood, such that parents can either *buffer against* environmental stresses or *exacerbate* a child's sense of insecurity [Shonkoff, 2012]. Notably, research has demonstrated deficits in regulatory competencies among children of depressed parents and children whose mothers have post-traumatic stress disorder. Overall, extreme and enduring stress can have profound and compounding consequences at the level of physiology and brain function, disrupting the self-regulatory capacity necessary for healthy functioning. Thus the link between mental health, executive functions and self-regulation is particularly significant given that depression is a leading contributor to the burden of disease globally and anxiety, stress and trauma-related disorders are highly prevalent in settings affected by war and community violence. Efforts to promote workplace productivity and educational achievement should consider the critical role of executive functions, self-regulation and socio-emotional skills for overall health and functioning. This is particularly important in areas of high conflict, poverty, and other stressors.

Building Human Capital: Developing Self-Regulation and Executive Function Skills

The growing scientific knowledge base on self-regulation, socio-emotional skills and the developing brain can be leveraged to engender new intervention approaches. There is significant evidence that structural and functional plasticity in many of the brain core centers involved in executive functions and self-regulatory processes exists not only during early childhood, but continuing into adulthood [Cunningham, Bhattacharyya, & Benes, 2002]. The development of self-regulatory capacity begins in infancy and is highly influenced by caregiver responsiveness [Brophy-Herb, Zajicek-Farber, Bocknek, McKelvey, & Stansbury, 2013]. Healthy development of executive functions early in life predict better self-regulatory capacity later in life [Kochanska, Murray, & Harlan, 2000; Rothbart, 2007] and is closely linked with educational and employment outcomes. However, in addition to childhood, adolescence is a key developmental period during which the brain undergoes significant changes associated with the capacity to self-regulate and respond appropriately and effectively to stress. While much emphasis has been put on early childhood development, tremendous opportunities exist to promote self-regulatory capacity and socio-emotional skills during adolescence and young adulthood as well [Heckman & Kautz, 2013]. Interventions to strengthen these competencies could also have inter-generational effects. For example, an intervention for 15–25-year-olds in stressful environments – including impoverished and conflict-affected areas – could not only improve classroom and interpersonal behavior in young adults, but could provide young parents with the capacity to establish nurturing and non-violent child-rearing patterns. This can serve to buffer their children against stressful environments and support skills development and human capital in the next generation [Lengua, Honorado, & Bush, 2007].

In considering intervention strategies, it is important to remember that individual interventions alone are insufficient. While recent increased attention to the science of early childhood development globally is an important advance, with it has come a proliferation of investments mainly in center-based early childhood programs. This investment in early childhood development is critical as there is no dispute that sensitive periods exist in brain development and that it is much less expensive and optimally impactful to invest in brain development in early childhood. However, given the science of neural plasticity throughout the life course and the importance of parental mental health and parent-child interactions for development of self-regulation and emotional/behavioral health in children, it is clear that the options for interventions in low-resource settings should extend more broadly, including family strengthening and support, interventions focusing on improving self-regulation in violence-exposed parents, and encouraging strong attachment and responsive parenting in families raising children in adversity. In particular, interventions should move beyond a narrow focus on infant stimulation and early childhood education to also consider the wellbeing of the adults providing care for children and the role of home- and community-based interventions. Greater investment is needed to attend to common mental health problems such as substance abuse and depression and to provide adequate support and care to parents raising children under situations of duress common in impoverished and violence-affected settings.

It's Time for Economists to Join Public Health Scientists, Psychologists and Neurologists in a Shared Agenda

As the field of global health and economic development increasingly recognizes the importance of more nuanced measures of executive functions and self-regulation skills, we need to collaborate with experts in neuroscience and human development to root our theories of change and intervention strategies in a robust scientific knowledge base. There is a substantial body of research on how self-regulation and more specifically executive functions affect health, education, and economic outcomes later in life. What is less understood is how interventions can foster these skills. In addition, very little research on executive functions has been conducted cross-culturally. In order to answer these questions, concerted, cross-disciplinary research efforts are required. A critical starting point entails laying out factors of self-regulation and socio-emotional skills most linked to a range of health and economic outcomes. Some of this has been started with the “big five” personality factors: conscientiousness, openness to experience, extraversion, agreeableness, and neuroticism/emotional stability. However, a focus on personality or such elements of “character skills” tends to imply a focus on immutable elements of personality rather than day-to-day elements of functioning and interpersonal relationships that are more malleable and can respond well to external intervention. A second task will be to develop tools and measures for these skills and competencies to be assessed validly and reliably in a variety of settings and cultures in order to generate comparable data. Within this effort there must be as much rigorous attention to measurement and psychometrics as is common in psychology, sociology, neuropsychology and human development. As a global health and development community, we ignore existing methods and research in these fields at our peril and risk wasting valuable time and limited resources.

Momentum from the paradigm shift in economics towards better-defined elements of human capital formation related to executive functions and self-regulation can help us arrive at greater synthesis of scientific knowledge across disciplines and professions. Consolidated research efforts can advance a better understanding of these essential elements of human capital formation and their role in social and economic success in many cultures and settings. These investments are critical to advancing the global health and development agenda.

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