Addressing the Divergence of the UDL Guidelines from the Developmental Neuropsychological View of Executive Function

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Abstract

In comparison with neuropsychological models of executive function (EF), which focus on multiple components of executive control and highlight the developmental nature of these skills, the UDL framework potentially overemphasizes more advanced EF skills such as self-monitoring and planning, and underemphasizes the role of core EF skills such as inhibitory control and working memory. Additionally, the UDL framework does little to support teacher understanding of EF as a neurodevelopmental skill. This overemphasis of more advanced EF skills and exclusion of core, earlier developing EF skills potentially leaves UDL practitioners unable to address the full range of variability among learner EF skills.

Keywords
Executive function, neurodevelopment

INTRODUCTION

The UDL guidelines were created to support the design of learning environments capable of flexibly addressing the spectrum of human variability (Meyer, Rose, Gordon, 2014). The framework is divided into three principles; Engagement, Representation, and Action and Expression. These principles are associated with "brain networks" that refer to the limbic system, parietal, temporal, and occipital lobes, and the frontal lobe respectively. The UDL principles are further divided into guidelines, each informed by research of best practices for supporting learning (Meyer, Rose, Gordon, 2014). As a key component for successful academic and social outcomes, executive function was included as a guideline within the principle of multiple means of action and expression, the principle (CAST, 2018).

Executive function (EF) is a broad term describing those skills required for purposeful, goal-directed activity, socially appropriate conduct, and the independent regulation of action and affect (Denckla, 1994; Lezak, 1993). EF skills can be considered a "domain of neurocognitive competence" (Denckla, 1994) that sets the stage for learning, academic achievement, and rule-governed behavioral functioning. In practical terms, EF involves developing and imple

menting an approach to performing a new or novel task that has not been habitually performed (Mahone et al., 2002). Learning new tasks or regulating behavior in the face of distraction or emotion requires executive or "top down" control of behavior and affect. However, once the task is no longer novel and skills become automatized, they require less executive control.

EF skills required for the cognitive control of behavior and affect show a protracted and somewhat uneven developmental trajectory. These skills develop throughout childhood and into young adulthood, concurrent with the development of neural synapses, myelination of brain regions, and recruitment and consolidation of neural networks (Stevens et al., 2009; Tau & Peterson, 2009). Early developing and core components of EF include response inhibition and working memory (Blair, 2002), with attention regulation providing the foundation for these skills.

Expanded definitions of EF also include mental flexibility or set-shifting, problem-solving skills, organization of behavior, and the capacity to delay gratification (Lezak, 1993, Barkley, 1997). Neuropsychological models of EF have been developed to consider the variety of EF sub-skills and the specific regulatory domains in which they fall. Domain-specific models, such as the BRIEF 2 (a neuropsychological rating scale of executive behaviors) group EF skills under the categories of behavioral (e.g., inhibit, self-monitor), affective (e.g., shift, emotional control), and cognitive (e.g., initiate, plan and organize behavior, working memory, task-monitoring, organize materials) regulation (Gioia et al., 2015; see Table 1).

EF DEVELOPMENT AS VARIABILITY

While categorization of EF sub-skills into three domains is helpful, Denckla's more recent model highlights *both* the diversity of EFs and the developmental emergence of these skills (Denckla & Mahone, 2018). This model considers the earlier developing core underlying skills that must be mastered before more complex EF skills can be reliably

demonstrated. For example voluntary regulation of attention and inhibitory control are critical for learning and developing other higher order cognitive skills.

Consideration of both the diversity of EF skills and their developmental trajectory is critical for understanding and applying to instructional practices, particularly as learning environments seek to address wide ranges of EF variability. The UDL framework, however, does not fully appreciate established models of EF.

EXECUTIVE FUNCTION IN THE UDL FRAMEWORK

The UDL EF guideline, "provide options for executive functions," explicitly identifies EF as higher level cognitive regulation skills (Table 1). The UDL guideline, "provide options for self-regulation," while not explicitly identified as EF, begins to represent the behavioral and affective domains of EF. Notably, the UDL EF guideline also includes a checkpoint that references "goal-setting" which as described, could not be appropriately placed within the three EF domains.

In comparison with neuropsychological models of EF, the design of the UDL framework potentially overemphasizes more advanced EF skills such as self-monitoring and planning, and makes no mention of the role of development and educational context. Notably, the reliance within the UDL guidelines on goal setting, planning, self-assessment, and self-monitoring falls well on the "advanced" end of the developmental curve, referencing only the most developmentally complex and later emerging skills –but without acknowledging the role of development. Without support for the core EF skills of inhibitory control and working memory, children in elementary grades will most likely struggle with these more advanced EF skills. In considering learner variability, it is also important to note that many students from pre-K through higher education — particularly those with disabilities— may also require support of earlier developing EF skills such as working memory or inhibitory control that are critical foundations for the more advanced EF skills (Bernstein & Waber, 2007; Jacobson & Mahone, 2012; Denckla, 2018).

Many teachers are unfamiliar with the concept of EF (Gilmore & Cragg, 2014). This lack of familiarity with EF suggests that for many educators, the UDL guidelines may be their first encounter with the term. To look at the EF guidelines and checkpoints, one might interpret EF as type of organizational skill utilized for completing projects, and fail to grasp the other ways in which EF is essential to academic learning such as mathematics, reading, and written expression.

Accessing the UDL Guidelines via the CAST website, a user is provided with a description of EF that hints at the developmental neuropsychological model of EF (CAST, 2018; Denckla & Mahone, 2018). The text describes supporting EF in two ways: "1) by scaffolding lower level skills so that they require less executive processing; and 2) by scaffolding higher level executive skills and strategies so that they become more effective and developed" (CAST, 2018). Unfortunately, this description is only provided to educators who read the more detailed descriptions of EF on the CAST website, as the framework does not name or describe "lower level" EF skills (inhibitory control, working memory) or how to support them, and instead focuses on supporting only the higher level skills. For example, while "supporting planning and strategy development" is included as a checkpoint within the EF guideline of the UDL framework, there is no mention of inhibitory control, the foundational skill and first stage of EF development.

The focus on later developing, higher-order EF within the UDL guidelines potentially contributes to a misunderstanding among educators as to how EF relates to student academic abilities. Without supporting and developing the core EFs (inhibitory control and working memory), supporting higher level EFs is a more difficult task. This focus on later developing, higher-level EFs is comparable to focusing on reading comprehension without first teaching decoding skills. Given the strong correlation between EF and student academic and social outcomes as well as the degree to which students benefit from targeted EF supports, it is essential that the UDL community clearly defines, understands, and appropriately supports EF within the learning environment (Diamond, 2013; Jacobson & Mahone, 2012).

Table 1. BRIEF2 EF domains compared to EF and Self-Regulation guidelines of the UDL framework.

	BRIEF 2	Executive Functions UDL Guideline	Self-Regulation UDL Guideline
Behavioral Regulation	Inhibit	--	--
	Self-Monitor	--	Develop self-assessment and reflection.
Cognitive Regulation	Initiate	--	--
	Plan/Organize thinking	Support planning and strategy development.	--
	Working Memory		--
	Task- Monitor	Enhance capacity for monitoring progress.	--
	Organization of Materials	Facilitate managing information and resources.	--
Affective Regulation	Shifting/Cognitive Flexibility		--
	Emotional Control	--	Facilitate personal coping skills and strategies.
	--	--	Promote expectations and beliefs that optimize motivation.
?	--	Guide appropriate goal setting.	

CONCLUSION

At the launch of the UDL guidelines version 2.0, David Rose commented, "Feedback is going to be essential to the guidelines being smarter" (CAST, 2018). We propose that by rewriting the UDL EF guideline checkpoints to more closely mirror developmental neuropsychological models of EF, the framework will better support educator

understanding of EF and, ultimately, student performance. Checkpoints that include supporting inhibitory control, working memory, and flexible thinking prior to strategic thinking or self-monitoring will better reflect and support the variability among student EF skills

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