

Negative emotions impact attention for learning in young school-aged children

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Learning requires attention, but the regulation of cognitive and emotional demands on attention is a complex executive skill for young children. We investigated the impact of cognitive load and negative affect on attention in school-aged children across time. Using innovative game-like computerized cognitive tasks, novel proof of concept data were collected and analyzed from 3 typically-developing children at 2 time points (first and second grades). All children were screened for comparable age-appropriate language and nonverbal intelligence and were right-handed, English monolinguals with no history of neurological/learning disorders. Task 1 measured the impact of cognitive load on attention using a dual-task paradigm. The primary task was a congruent Simon attention task, and the secondary task was a word-level speech recognition task presented in quiet and in speech-shaped noise (+10 dB SNR). Task 2 measured the impact of emotional valence (V) and arousal (A) on attention using a facial affect task. Children mirrored line drawings depicting happy (+V, +A), angry (-V, +A), and sad (-V, -A) facial expressions. To measure attention, children pressed a button when they saw a line drawing of a neutral chimpanzee ape face. Both tasks were presented randomly in a block design with practice. We predicted that cognitive load and negative emotions would trade off with executive attentional resources, and regulating this trade off may improve over time. Accuracy and reaction time were analyzed with linear mixed-effects modeling in R. For Task 1, children were less accurate and responded faster when listening in noise compared to quiet. Performance did not improve over time. For Task 2, children responded fastest during happy, slower during angry, and slowest during sad emotional states. Children responded faster over time, but the pattern between emotions remained the same. These findings suggest that early childhood attention is sensitive to changes in emotional states. Listening to speech in noise typical of a busy classroom can increase cognitive load and trade off with attention flexibility, which impacts children across grade levels. Likewise, negative affect trades off with processing speed, even across the maturational development of these emotions. Next, we will test the relationship between these behavioral patterns and physiological measures of cognition (fNIRS brain imaging) and emotion (thermal infrared imaging). These findings provide new insight about optimal learning conditions for young children and across life. The goal of this work is to translate such combined behavioral/neuroscience studies to benefit clinical groups.