Addressing the Effects of and Interventions for the Impact of Stress on Learning

by Judy Willis

Educators are positioned to be the footholds students need to make school remote and classroom-based safe havens where they can rebuild emotional comfort as well as build knowledge. Teachers with this understanding become more powerful, critical motivators to reduce the negative impacts of high stress. They can adjust their teaching practices and build learning climates which enable all students to boost their emotional resilience and reach higher levels of cognition.

The Impact of High Stress on the Brain

The study of the brain lends critical information to the understanding of the way students process trauma and react in stressful environments - information that will be critical as educators start to adapt to teaching in the wake of COVID-19. Research has shown that when the brain is burdened by sustained high stress or perceived threat, it follows its programing into survival mode. The amygdala, the brain structure that basically serves as an emotionally reactive switching station, has shown to become overloaded by cellular activity in response to threat, fear, and high stress. Behavioral control then becomes dedicated to survival, and responses become more reactive and involuntary.[1]

Highly stressed students, reacting to discomfort, academic frustration, or emotional struggles, slip into this involuntary survival state with reactive behavior and impaired memory construction. These responses, even though involuntary, can be misinterpreted by teachers, and the students themselves, as intentional misbehaviors.[2,3]

It may manifest as frequent trips to the bathroom or the drinking fountain, restlessness or provocation, and daydreaming or loss of attention and focus.

Opportunities for Educators

When teachers understand the neuroscience of stress impacting the brain, they recognize that the brain's responses in high stress states are not necessarily voluntary student choices and therefore are not representative of students' behavioral or academic potentials. Instead of attributing these responses to willfulness, laziness, or low intelligence, educators can provide more supportive interventions to reduce the impact of stressors on their students' learning and emotional self-regulation.

Similarly, teaching students about their brains' powers of neuroplasticity, the brain's ability to reorganize learned connections, can help them to understand that they have the neural capacity to build the brains, behaviors, skills, and academic outcomes they seek. Studies show that students taught about their neuroplastic potentials show outcomes of increased emotional self-management, more successful learning, and greater academic success. Of note, the positive responses were especially evident in students designated as being from low-income minority groups.[4]

Neuroscience-informed teachers can guide students and parents through the process of understanding these responses and appropriately addressing them. The inherent malleability of the brain means that educators have the opportunity to equip students with the tools they need to build the brains, behaviors, skills, and academic outcomes they seek.

Emotions are inseparable from students' responses to learning, engagement with school, and ultimate achievement. When students build strategies for self-management, they open themselves up to more successful, motivated learning and positive school experiences.[5] Tools for building students' emotional self-management start with their developing emotional self-awareness and build up to self-management strategies such as mindfulness, guided relaxation, and visualization for students to use to mitigate emotional discomfort.[6]

When students learn about their brains' survival reactions to stress, they have the keys to change their beliefs, responses, and success as well as open themselves up to more successful, motivated learning and positive school experiences.[7] As teachers use their understanding and related strategies, they, themselves, increasingly recognize their positive impact on their students' behaviors, efforts, mindsets, and achievements. This awareness heightens their own confidence and commitment to continue to use their skills beyond the current trauma, and to promote greater self-efficacy in all learners as time goes on.[8]

Teachers as Guardians of Classroom Climate

Research correlations support what experienced educators have known all along about the important role that emotional comfort plays in students' resilience to high stress and access to academic achievement. Optimal conditions develop when teachers promote an emotional

climate that allows students to feel safe, positively supported for engagement, and free from perceived threat to their physical and emotional selves and their property.[9]

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[1] Motzkin, J., Philippi, C. L., Wolf, R. C., Baskaya, M. K., & Koenigs, M. (2015). Ventromedial prefrontal cortex is critical for the regulation of amygdala activity in humans. *Biological Psychiatry, 77*(3), 276–284. doi: 10.1016/j. biopsych.2014.02.014; Ressler, K. (2010). Activity, Fear, and Anxiety: Modulation by Stress. Biol Psychiatry. 2010 Jun 15; 67(12): 1117–1119; Willis, J.W. (2014) Neuroscience reveals that boredom hurts. Phi Delta Kappan. 95 (8). P 28-32. https://kappanonline.org/neuroscience-reveals-that-boredom-hurts-willis/; *Variable stress responses.* Stressful events do not necessarily lead to a stress response or to the same stress response in all individuals. One's background experiences, resilience, and level of preexisting stress and stress-management strategies at the time can influence how their brains interpret and cope with high stress (Vogel & Schwabe, 2016).

[2] Lupien, S. J., McEwen, B. S., Gunnar, M. R., & Heim, C. (2009). Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nature Reviews Neuroscience, 10*(6), 434–445. doi: 10.1038/nrn2639; Quesada, A. A., Wiemers, U. S., Schoofs, D. & Wolf, O. T. (2012, January). Psychosocial stress exposure impairs memory retrieval in children. *Psychoneuro- endocrinology, 37*(1), 125–136; Valizadeh, L., Farnam, A., & Rahkar Farshi, M. (2012). Investigation of stress symptoms among primary school children. *Journal of Caring Sciences, 1*(1), 25–30.

[33] *Additional section of background neuroscience knowledge: the brain's dopamine-reward response system.* Teachers and students can also reduce stress and promote positivity and perseverance by tapping into the intrinsic motivation power of the dopamine-reward response. (See articles: Arsenault JT, Nelissen K, Jarraya B, & Vanduffel W. (2013). Dopaminergic reward signals selectively decrease fMRI activity in primate visual cortex. *Neuron*. *77*(6):1174-1186; Nakahara, H. (2014). Multiplexing signals in reinforcement learning with internal models and dopamine. *Current Opinion in Neurobiology*, *25*, 123-129.)

Dopamine is the neurotransmitter most closely associated the experience of intrinsic motivation, especially from achieving challenges (See articles: Anderson, B. A., Kuwabara, H., Wong, D. F., Gean, E. G., Rahmim, A., Brašić, J. R., George, N., Frolov, B., Courtney, S. M., & Yantis, S. (2016). The Role of Dopamine in Value-Based Attentional Orienting. *Current Biology: CB*, *26*(4), 550–555; Berke J. D. (2018). What does dopamine mean? *Nature Neuroscience*, *21*(6), 787–793; Boot, N., Baas, M., van Gaal, S., Cools, R., & De Dreu, C. (2017). Creative cognition and dopaminergic modulation of fronto-striatal networks: Integrative review and research agenda. *Neuroscience and Biobehavioral Reviews*, *78*, 13–23; Cerasoli, C. P., Nicklin, J. M., & Ford, M. T. (2014). Intrinsic motivation and extrinsic incentives jointly predict performance: a 40-year meta-analysis. *Psychological Bulletin*, *140*(4), 980–1008; Robinson, L. J., Stevens, L. H., Threapleton, C. J. D., Vainiute, J., McAllister-Williams, R. H., &Gallagher, P. (2012). Effects of intrinsic and extrinsic motivation on attention and memory. *Acta Psychologica, 141*(2), 243-249.)

When dopamine levels increase in response to its release mechanisms, the associated satisfaction and pleasure are usually accompanied by enhanced perseverance, motivation, and memory (See article: Bergey, C. M., Phillips-Conroy, J. E., Disotell, T. R., & Jolly, C. J. (2016). Dopamine pathway is highly diverged in primate species that differ markedly in social behavior. *PNAS: Proceedings of the National Academy of the United States of America*, *113*(22), 6178-6181.)

Teachers can incorporate dopamine boosters, such as choice, music, optimism, movement, positive interactions with peers, being read to, acting kindly, expressing gratitude, humor, and especially experiencing the achievement of challenges. These dopamine boosts are especially valuable when students are stressed, but also can serve to enhance learning in general (See articles: Anderson, B. A., Kuwabara, H., Wong, D. F., Gean, E. G., Rahmim, A., Brašić, J. R., George, N., Frolov, B., Courtney, S. M., & Yantis, S. (2016). The Role of Dopamine in Value-Based Attentional Orienting. *Current Biology: CB*, *26*(4), 550–555; Berke J. D. (2018). What does dopamine mean? *Nature Neuroscience*, *21*(6), 787–793; Boot, N., Baas, M., van Gaal, S., Cools, R., & De Dreu, C. (2017). Creative cognition and dopaminergic modulation of fronto-striatal networks: Integrative review and research agenda. *Neuroscience and Biobehavioral Reviews*, *78*, 13–23; Cerasoli, C. P., Nicklin, J. M., & Ford, M. T. (2014). Intrinsic motivation and extrinsic incentives jointly predict performance: a 40-year meta-analysis. *Psychological Bulletin*, *140*(4), 980–1008; Robinson, L. J., Stevens, L. H., Threapleton, C. J. D., Vainiute, J., McAllister-Williams, R. H., &Gallagher, P. (2012). Effects of intrinsic and extrinsic motivation on attention and memory. *Acta Psychologica, 141*(2), 243-249.).
With the powerful dopamine response to achieving challenges, providing students individualized opportunities to progress toward their defined goals at their mastery levels, implements a valuable intervention for all learners. With opportunities to progress at their individual achievable challenge levels, the *barriers are lowered, but not the bar*. Especially when stressed, frustrated, or encumbered by expectations of failure, students need more frequent feedback of their ongoing progress on route to the goals to engender dopamine response. This individualizing takes much time and work. But experiencing the exhilarating impact on even just one student at a time, will boost teachers' own dopamine response and motivate their efforts to persevere.

[4] Good, C., Aronson, J. M., & Inzlicht, M. (2003). Improving adolescents' standardized test performance: An intervention to reduce the effects of stereotype threat. *Journal of Applied Developmental Psychology*, *24*(6), 645–662.

[5] Mega, C., Ronconi, L., & De Beni, R. (2014). What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic achievement. *Journal of Educational Psychology, 106*(1), 121–131

[6] Kohn, N., Eickhoff, S. B., Scheller, M., Laird, A. R., Fox, P. T., & Habel, U. (2014). Neural network of cognitive emotion regulation—an ALE meta-analysis and MACM analysis. *Neuroimage, 87*, 345–355; Razza, R. A., Bergen-Cico, D., & Raymond, K. (2015). Enhancing preschoolers' self-regulation via mindful yoga. *Journal of Child and Family Studies, 24*(2), 372–385.

[7] Mega, C., Ronconi, L., & De Beni, R. (2014). What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic achievement. *Journal of Educational Psychology, 106*(1), 121–131

[8] Hermans, E. J., Henckens, M. J., Joëls, M., & Fernández, G. (2014). Dynamic adaptation of large-scale brain networks in response to acute stressors. *Trends in Neurosciences, 37*(6), 304–314; Schwabe, L., Tegenthoff, M., Höffken, O., & Wolf, O. T. (2012). Simultaneous glucocorticoid and noradrenergic activity disrupts the neural basis of goal-directed action in the human brain. *Journal of Neuroscience, 32*(30), 10146–10155; Willis, J.W. (2014) Neuroscience reveals that boredom hurts. *Phi Delta Kappan*, *95*(8). 28-32. https://kappanonline.org/neuroscience-reveals-that-boredom-hurts-willis/

[9] Reyes, C. R., Brackett, M. A., Rivers, S. E., White, M., & Salovey, P. (2012). Classroom emotional climate, student engagement, and academic achieve- ment. *Journal of Educational Psychology, 104*(3), 700–712.