Introduction

What causes some students to overcome significant adversity, while others quit when met with the slightest challenge? What enables a student to fail an exam, learn from the experience, adjust her study strategies, and earn the top grade on the next exam? Do different students’ brains tend to respond to challenges in different ways? Research reveals that there is much more to academic success than intellectual talent – there are certain dispositions that can propel students to success. What are these “secret ingredients” to success? Exciting new research has pinpointed two dispositions that powerfully impact achievement in school and beyond: growth mindset and grit (Dweck, 2006; Duckworth et al., 2007).

While extensive research indicates that these dispositions foster learning and achievement, more research is needed on how educators can support the development of these dispositions. What pedagogical approaches effectively cultivate these dispositions? Which component skills underpin these dispositions? How can those component skills be taught?

Harvard Graduate School of Education researchers are partnering with teachers and administrators at Wellington College, Bulmershe, Waingels, and St. Crispins to explore these questions. This literature review synthesizes existing research on growth mindset and grit, and explores a constellation of interrelated skills that may partly underpin these dispositions, including mastery goals, metacognition, and self-compassion.
GROWTH MINDSET

What are mindsets?

Three decades ago, educational psychology professor Carol Dweck and her colleagues began investigating why certain students viewed challenges positively and were able to “bounce back” from failures, while others were less resilient in the face of challenge and adversity. Out of years of research came her groundbreaking finding: the type of mindset individuals adopt can have profound implications for how they conceive their learning and personal characteristics (Dweck, 2006; Dweck et al., 1995; Dweck & Legget, 1988; Molden & Dweck, 2006). Individuals with a fixed mindset believe that their qualities are “set in stone” and remain fundamentally unchanging throughout the lifespan. Conversely, individuals with a growth mindset believe that their basic qualities are malleable and can be cultivated through effort and learning. While both beliefs are still commonly held among students, recent neuroscience research shows that the brain’s architecture continually adapts as we learn (OECD, 2007), indicating that belief in a growth mindset is scientifically accurate, whereas belief in a fixed mindset is a misconception.

One’s mindset is closely linked to the implicit theories one has about intelligence. Students with fixed mindsets (“entity theorists”) tend to believe that intelligence is dependent on innate ability rather than effort. Fixed mindset individuals tend to view failure as evidence of their own immutable lack of ability and consequently disengage from tasks when they err or struggle (Dweck, 2006; Robin & Pals, 2002). On the other hand, students with a growth mindset
(“incremental theorists”) tend to understand that intelligence and academic skills are changeable and that success relies mostly on the amount of effort one puts in, not just original talent. Growth-minded students view failures as potential chances for instructive feedback and thus are more likely to learn from their mistakes (Dweck, 2006). How students perceive intelligence can significantly impact the way they approach schoolwork, particularly when it comes to coping with adversity. This is of critical importance because, as any good teacher knows, the greatest opportunities for learning and growth tend to involve some degree of challenge and failure along the way (Kaufman, 2013).

**Mindsets and academic achievement goals**

Research suggests that students’ mindsets may be partially due to their academic achievement goals. Researchers have identified two different categories of achievement goals: mastery and performance. With mastery goals, the key concern is long-term skill development; the learning process itself is appreciated and it is understood that mastery is dependent on effort (Ames & Archer, 1988). Conversely, performance goals are tied to external outcomes (e.g. grades, teacher praise) and the primary concern is demonstrating ability, usually by outperforming others or by achieving success with little effort (Ames & Archer, 1988). Students with performance orientations fall into two subsets: performance-approach goals and performance-avoidance goals (Elliot & Church, 1997; Middleton & Midgley, 1997). With performance-approach goals, students try to show competence by doing better than others. With performance-avoidance goals, students try to show competence – or more accurately, a lack of incompetence – by avoiding situations in which failure may occur.

As might be expected, research indicates that fixed mindsets are correlated with performance goals, while growth mindsets are correlated with mastery goals (Ames & Archer,
Students with mastery goals are more likely to be intrinsically motivated, ask for help with schoolwork when needed, and view mistakes and setbacks as part of the natural learning process (Elliot & Church, 1997; Neff, 2004). Performance-avoidance goals are associated with low levels of intrinsic motivation, high anxiety, low feelings of self-efficacy, and learned helplessness (Elliot & Church, 1997). Research on performance-approach goals suggests that they can have different effects depending on the emotional impact of a learning experience. When learning is accompanied by positive emotions, performance-approach goals are correlated with motivation and greater persistence (Smiley & Dweck, 1994). However, in negative affect situations, students with performance-approach goals are more likely to show higher levels of anxiety, an unwillingness to seek help, and disruptive classroom behavior (Smiley & Dweck, 1994). Students with a more performance-oriented approach to learning may have outward academic success in situations that they do not find particularly difficult or upsetting, which can mask their underlying dispositions (Dweck, 2008). However, when these students inevitably face challenges or setbacks, their reaction is often disengagement and avoidance, which prevents them from engaging in learning opportunities that develop their abilities, and can therefore cause them to fall further and further behind as time passes.

**Neuroscientific basis for mindsets**

Recent neuroscience research has explored the neural underpinnings of fixed and growth mindsets. It is important to keep in mind that the neural correlates of these mindsets that researchers have identified represent a snapshot of an individual’s current state of mind. The brain continually adapts based on experience throughout life (OECD, 2007) so a student with a fixed-mindset at one point in time can develop a growth-mindset, and the associated neural correlates, in the future.
Mangels et al. (2006) used event-related potentials (ERPs) to study how individuals’ mindsets affect their information processing skills during a challenging knowledge test. They found that, compared with fixed mindset individuals, those with a growth mindset paid greater attention when given negative feedback about their mistakes, were more likely to correct those mistakes on a surprise retest, and demonstrated greater overall gains in knowledge. Interestingly, when the fixed mindset individuals were alerted to their mistakes, they showed associated responses in frontal brain regions associated with increased attention, but relatively reduced responses in areas associated with information processing and memory storage. This result suggests that students with a fixed mindset direct their attention to feedback about what they did wrong, at least to an extent, but their brains appear to be relatively less engaged in processing this feedback to learn from it. These group differences may help explain why growth mindset individuals bounce back from academic failure more effectively than their fixed mindset peers.

While the study by Mangels et al. (2006) investigated the relationship between mindsets and external corrective information (i.e. the participants were aware of their mistakes only when signaled by external feedback), another related study assessed the effect of mindset on individual’s own self-monitoring of their mistakes. Consistent with prior research findings, Moser et al. (2011) found that, compared to a fixed mindset, a growth mindset was associated with greater “online awareness” of errors. In other words, the growth-minded individuals were better at “catching” their own mistakes, and this greater attention made them more likely to fix their errors (“post-error accuracy”) so they could learn from them. Fixed-minded individuals also noticed their mistakes, although to a lesser degree, but showed noticeably reduced “post-error accuracy.” Findings from this study suggest that increased awareness of and attention to errors is linked to growth minded individuals’ greater abilities to learn from mistakes.
If a key part of a growth mindsets adaptive power is greater “online” error awareness, then what provokes fixed-minded individuals to go “offline” when they make mistakes or receive corrective feedback? A compelling argument from the latest neurocognitive research is that the self-defeating nature of a fixed mindset may be linked to emotional dysregulation. Research has shown that there are mindset-related differences in areas of the brain (i.e. the anterior cingulate cortex) known to play a role in emotion regulation, social and emotional processing, and decision-making. Fixed-minded individuals tend to show greater activation in these brain regions, which may suggest that they find negative feedback more personally salient and distressing than growth-minded individuals (Mangels et al., 2006). While growth-mindset students typically view feedback as a tool to improve their abilities, fix-minded students tend to feel threatened by negative feedback because, for them, it feels like shining a spotlight on their fixed low abilities. Moreover, emotion regulation difficulties can lead to chronic feelings of anxiety and poor emotional coping strategies, making it less likely that fixed-minded individuals will be in an optimal state to learn (Molden & Dweck, 2006). In this way, negative emotion plays a key role in fueling what one might think of as a fixed mindset’s downward spiral of learned helplessness.

**Mindset interventions: Reducing risk, promoting resilience**

Encouraging research suggests that students with a fixed-mindset can learn to develop a growth mindset, which can make their learning experiences much more positive and successful (Dweck, 2006; Poile, Hinton, Glennon, & Townley, in press). Many compelling examples of how mindsets and implicit theories of intelligence can impact students’ academic success come from studies on stereotype threat in classroom contexts. Stereotype threat is defined “as being at risk of confirming, as a self-characteristic, a negative stereotype about one’s group” (Steele &
Aronson, 1995). Stereotype threat is of particular relevance to mindset theory because negative stereotypes are essentially “fixed mindset labels” (Dweck, 2008; 2006). They imply that certain traits or abilities are innate; some groups have them while others do not. Over the years, numerous studies indicate that stereotype threat harms the academic performance of various groups, including students from low socioeconomic backgrounds (Croizet & Claire, 1998); females in math and science (Dar-Nimrod & Heine, 2007; Good, Aronson, & Harder, 2008; Good, Rattan, & Dweck, 2007; Inzlicht & Ben-See, 2000); Black and Hispanic students on standardized tests (Steele & Aronson, 1995); and even white males when primed with information about Asian superiority in math (Aronson et al., 1999). A number of these studies have pointed out that the long-term negative effects of stereotype threat may contribute to educational and social inequality, as a consequence of groups being systemically disempowered to pursue certain areas of study (Good et al., 2008a).

Exciting new research suggests that instilling a growth mindset in groups vulnerable to stereotype threat can serve as an inoculation that protects them from negative messages about their abilities (Dweck, 2008). For example, in one study, African-American college students at risk for stereotype threat received lessons about growth mindset, multiple intelligence training, or no treatment, and results revealed that the group of students who learned about growth mindset earned higher grades than the control groups who received either multiple intelligences training or no treatment (Aronson, Fried, & Good, 2002). In another study of female and minority 7th graders at risk for stereotype threat, students who received a growth mindset workshop received significantly higher standardized test scores than those who did not (Good, Aronson, & Inzlicht, 2003). In yet another study, which took place in a real school setting, 7th graders were taught either about mindsets or study skills. The students were tracked over two years, and results
showed that students who were taught about mindsets had greater motivation in school and earned higher grades than the control group who were taught study skills (Blackwell, Trzesniewski, & Dweck, 2007). Together, this research suggests that encouraging a growth mindset not only insulates students from negative learning experiences like believing negative stereotypes about certain groups, but also has direct positive impacts on academic achievement.

**How can educators support a growth mindset?**

Researchers are beginning to understand how educators can encourage a growth mindset, but more research is needed in this area. Research suggests that teaching students about brain plasticity, or the brain’s ability to adapt based on experience, is an effective way to cultivate a growth mindset (Dweck, 2006; Poile, Hinton, Glennon & Townley, in press). Teachers can also influence their students’ mindsets through feedback and praise. Many studies indicate that, contrary to popular belief, ability-centered or intelligence-centered praise can have a number of detrimental effects when children believe the praise to be insincere (Meyer, 1992), or when it makes them feel pressured to replicate or exceed their performance in the future (Baumeister, Hutton, & Cairns, 1990). In one influential study, fifth-grade students praised for their intelligence subsequently cared more about performance goals than mastery goals, while students praised for effort focused more on mastery goals than performance goals (Mueller & Dweck, 1998). Moreover, after failure, the intelligence-praise group displayed less task persistence, less enjoyment, and even showed worse performance on subsequent re-tests. However, those praised for their effort maintained their levels of motivation and performance, even when faced with challenge. Perhaps the most notable finding was that after the intervention students praised for their intelligence were more likely to describe it as a “fixed” trait than those who were praised
for hard work, who tended to rate intelligence as being “subject to improvement” (Mueller & Dweck, 1998).

Since students’ mindsets are likely influenced by their academic achievement goals, learning environments that cultivate a mastery goal orientation are likely to encourage a growth mindset as well. An evaluative study on achievement goals suggests that educators can foster a mastery goal orientation by creating a learning environment that emphasizes the following: (1) social activities to build peer relationships; (2) customized instructional design to offer appropriate levels of challenge; (3) adequate time for confusion and self-reflection; (4) intellectual risk-taking and self-directed learning; and (5) reduced opportunities for social comparison (Ames et al., 1992; Kaufman, 2013). After interventions targeting these elements, students show an increase in mastery goal orientations and a decrease in both types of performance goal orientations. In addition, there is a significant decrease in the tendency for students’ self-worth to be contingent on outperforming others (Ames et al., 1992). More research is needed to explore the potential to promote growth mindset by creating learning environments that are conducive to a mastery goal orientation.

**GRIT**

**What is grit?**

Angela Duckworth, who is widely regarded as the pioneer of grit research, defines grit as “passion and perseverance for goals over the very long-term” (Duckworth, 2011; Duckworth et al., 2007). Duckworth’s (2007) definition implies grit is a two-pronged construct, consisting of individual effort and interest. Grit and growth mindset are interdependent and mutually reinforcing. In fact, a meta-review by the U.S. Department of Education defines grit as “perseverance to accomplish long-term or higher-order goals in the face of challenges and
setbacks” by engaging the student’s psychological resources, “such as their academic mindsets” (OET, 2013). Students who have a growth mindset are more likely to preserve toward long-term goals, even in the face of challenges, because they believe they can make progress through hard work. At the same time, students who are gritty tend to stick with challenging learning processes long enough that they have an opportunity to see their skills develop over time, which reinforces a growth mindset. More research is needed to understand the dynamic, interdependent relationship between growth mindset and grit.

Grit may be particularly important for secondary school students since research suggests that pursuing long-term goals, especially those related to academic work, can be particularly challenging for many adolescents (Romer, Duckworth, Sznitman, & Park, 2010). Striving to attain most schoolwork-related goals requires sustained concentration and self-regulation in the face of boredom and setbacks. Even adolescents who are considered traditionally “good students” sometimes lack intrinsic motivation when it comes to most schoolwork, and instead rely on extrinsic rewards like good grades or teacher praise (Duckworth et al., 2011). Of course, this is not always the case, and research shows that nurturing supportive relationships, providing students with autonomy, and offering learning activities at an optimal level of challenge, all positively impact students’ intrinsic motivation and academic achievement (Glennon, Hinton, Callahan, & Fisher, 2013; Hinton, Osgood-Campbell, & UK, in press; OET, 2013; Ryan & Deci, 2000). Yet even when students are generally intrinsically motivated, there will always be certain tasks along the way that require taking a long-term perspective and mustering up the will to get the job done. Grit can help students approach learning processes with big picture thinking that emphasizes mastery and process and views setbacks as “bumps in the road” (Dweck, 2006).
Compelling research indicates that grit is associated with positive academic outcomes. Studies have shown that grit is a significant predictor of academic success when measured by final grades, standardized tests, formative assessments, academic competitions, attendance, and enrollment into selective secondary schools (Duckworth, 2005, 2010, 2011). Moreover, research has found grit to be a better predictor of success than IQ in both school and the workplace (Duckworth & Seligman, 2005). While research has thoroughly demonstrated the benefits of being a gritty student, more research is needed on what educators can do to nurture grit in students who lack this disposition. Toward this end, researchers can explore skills that may underpin grit, and how educators can help students develop these skills. We hypothesize that grit involves a cluster of interrelated skills, including metacognition and self-compassion, among others.

**Metacognition and grit**

Persevering through setbacks to accomplish long-term goals – being gritty – requires students to have effective learning strategies. Researchers refer to this construct as metacognition. Flavell (1979), the researcher responsible for coining the term metacognition, discusses two components of this ability: metacognitive knowledge and metacognitive experiences. *Metacognitive knowledge* refers to understanding your cognitive process in context, while *metacognitive experiences* refers to applying strategies derived from this understanding. These two elements are inextricably linked and work together. Metacognitive skills include setting learning goals, developing a plan to work toward those goals, strategically implementing that plan, adapting strategies as necessary when faced with challenges, and finally reflecting on the learning experience (Costa, 2001).
Teaching metacognition empowers students to take charge of their own learning. Metacognitive skills give students the tools they need to plan and monitor their learning processes and work through obstacles along the way, which enables them to be gritty as they work toward long-term goals. Metacognitive skills foster academic achievement, including a range of high-level learning outcomes that are typically difficult to achieve. Metacognitive skills are associated with the ability to critically evaluate information, deeply understand academic content, transfer knowledge, and creatively synthesize and apply knowledge (Bransford, Brown & Cocking, 2000; Fadel, 2011). Moreover, research suggests that students with strong metacognitive skills are more likely to grow into lifelong learners (Bransford, Brown & Cocking, 2000; Fadel, 2011).

Many researchers have explored how educators can cultivate metacognition. Research suggests that pedagogy that is student-centered and encourages reflection supports metacognition (Tanner, 2012). Researchers have identified specific pedagogical tools that scaffold students’ metacognitive skills as well. Reflection journals, reciprocal teaching, explicit discussions about the process of learning, and using prompt questions during learning activities have all been shown to build metacognitive skills (Bransford, Brown, & Cocking, 2000; Joseph, 2010; Swartz & Parks, 1994). Making use of self-assessments and formative assessments throughout the learning process can also help students’ develop metacognitive skills (Bransford, Brown, & Cocking, 2000; Joseph, 2010; Swartz & Parks, 1994). More research is needed to explore the relationship between metacognition and grit, as well as how educators can support grit by teaching metacognitive skills.

**Grit with self-compassion**

Does being gritty require pursuing long-term goals at all costs, swallowing negative emotions and sacrificing wellbeing along the way? While more research is needed on the
emotional processes underlying grit, we hypothesize that being gritty may actually depend on the opposite – processing emotions in psychologically healthy ways that support wellbeing. Research indicates that grit is negatively correlated with neuroticism, anxiety, depression, and ruminative thoughts, suggesting that individuals with higher levels of grit may be less susceptible to negative emotions (Kirby, Morrow, & Yih, 2014). If students are processing emotions in destructive ways, they will be more likely to break down or burn out in pursuit of very long-term goals. By contrast, if students have adaptive emotional regulation skills, they will be more resilient when the “going gets tough” as they work toward long-term goals. We therefore posit that effective emotional regulation strategies may partly underpin grit.

Specifically, we hypothesize that self-compassion may be an underlying skill that contributes to grit (Poile, Hinton, Glennon & Townley, in press). Self-compassion is a construct derived from Buddhist psychology that is an effective emotional regulation strategy. Self-compassion involves being open to one’s painful experiences, offering kindness to oneself rather than harsh criticism, taking a mindful, non-judgmental stance towards one’s inadequacies, and recognizing that failure is part of the broader human experience (Neff, 2005). While self-compassion is correlated with self-esteem, it is distinct in that it is not contingent on social comparison, performance outcomes, or other external influences (Neff 2003; Neff et al., 2005). Therefore, self-compassion enables a student to experience positive feelings about himself without needing to protect or inflate his self-concept.

Practicing self-compassion can serve as an effective emotional regulation tool that supports learning. It is positively associated with emotional intelligence, self-determination, and subjective psychological wellbeing, and negatively associated with self-criticism, depression, anxiety, rumination, and thought suppression (Neff, 2003). Indeed, a small but promising body
of research evidence supports self-compassion’s positive effect on emotion regulation and failure coping strategies. Two studies by Neff et al. (2005) investigated the relationship between self-compassion, academic achievement goals, and coping with perceived academic failure. The first study found that self-compassion was positively associated with mastery goals and negatively with performance goals, a relationship that was mediated by self-compassionate individuals’ lesser fears of failure and greater perceived competence. The second study involved a sample of students who perceived a recent test grade as a failure, and its results showed that self-compassion was positively correlated with healthy emotional coping strategies and negatively correlated with avoidance-oriented strategies. More research is needed to explore how self-compassion might contribute to grit, and to develop effective strategies for nurturing self-compassion as a component of grit.

**Conclusion**

Neuroscience research shows that brain’s abilities continually develop in response to learning experiences (OECD, 2007). Engaging in learning experiences is therefore necessary for improving one’s abilities. Students with a growth mindset and grit readily engross themselves in learning experiences, which gradually develop their abilities. This leads to an upward spiral of engagement, learning, and academic success. By contrast, students who have a fixed mindset and are not gritty may avoid or quickly disengage from learning experiences, which will deprive them of opportunities to develop their abilities. As a result, their abilities will not improve, which will cause them to further disengage, resulting in a downward spiral in which they fall further and further behind. This cocktail of disengagement and avoidance amounts to academic suicide.

It is therefore critical for educators to understand how to support growth mindset and grit to ensure that all students have the opportunity to reach their full potential. More research is
needed to understand the dynamic, interdependent relationship between growth mindset and grit. In addition, more research is needed to identify the constellation of interrelated skills that contribute to these dispositions, such as mastery achievement goals, metacognition, and self-compassion, among others. Finally, further research is needed on what pedagogical approaches effectively foster growth mindset and grit, as well as the skills that underpin them. In this study, Harvard Graduate School of Education researchers are partnering with Wellington College and three affiliated state schools to explore these areas of research. We will explore relationships among various key constructs. Following this, we will develop interventions that target growth mindset and grit, as well as skills that underpin them, and assess their impact on a diverse population of secondary school students. This research will contribute to an emerging knowledge base on how educators can cultivate growth mindset and grit. If we can effectively teach these powerful dispositions in school, we will poise our students to lead successful, resilient, and fulfilling lives.
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